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North Carolina Department of Transportation
Statewide Planning Branch
Systems Planning Unit

THOROUGHFARE PLAN FOR

October, 1996

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Thoroughfare Plan for the City of Kings Mountain

Prepared by the:

Statewide Planning Branch
Division of Highways
N. C. Department of Transportation

In Cooperation with:

The City of Kings Mountain
The Federal Highway Administration
U. S. Department of Transportation

NORTH CAROLINA PROFESSIONAL SEAL 18446 ENGINEER MICHAEL S. BRUFF

October, 1996

Acknowledgements

Persons Responsible For This Report:

Project Engineer:	Anna E. Hayes Brigman
Systems Planning Engineer:	Mike Bruff, P.E.
Urban Group Manager:	A. Blake Norwood, P.E.
Manager Statewide Planning Branch:	M. R. Poole, Ph.D., P.E.
Project Technician:	Jocelyn M. Jones

Special thanks to the Kings Mountain Thoroughfare Planning Committee.

Executive Summary

In July of 1990, a formal agreement was made between the City of Kings Mountain and the Statewide Planning Branch of the North Carolina Department of Transportation to begin an update of the 1979 Kings Mountain Thoroughfare Plan (not adopted). The resulting Kings Mountain Thoroughfare Plan (refer to **Figure 3, page 11**) was developed using the thoroughfare planning principles described in **Appendix A** of this report.

The study is based on the traditional four step planning process: trip generation; trip distribution; mode choice; and trip assignment. The study involved two repetitions of this process. First, socioeconomic data, traffic count data, and geometric street data collected in 1990 were used to simulate the area's 1990 traffic patterns. When the traffic model accurately reproduced the traffic counts, the socioeconomic data and the external station volumes were projected to the design year (2020) and applied to the same four step process to forecast future traffic patterns. The future traffic patterns were then compared to existing capacities and possible solutions to the anticipated problems were tested.

This report documents the findings of the study and the resulting recommendations (refer to **Figure 4, page 17**). It includes recommendations for thoroughfare cross-sections, cost estimates and benefit evaluations for the recommended improvements, and recommendations for plan implementation.

Following several informational meetings with the Kings Mountain Thoroughfare Planning Committee, the Planning Board, and the City Council, a public hearing was held on June 25, 1996. The Kings Mountain Thoroughfare Plan was adopted by a 6 to 1 vote following the hearing.

Initiative for plan implementation will rest largely with the policy boards and citizens of the area. Highway needs throughout the State exceed the available funding. Therefore, local areas should aggressively pursue funding for desired projects.

It should be emphasized that the recommended plan is based on anticipated growth and development of the planning area and reflects the current zonal trends provided by the City of Kings Mountain. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific design requirements.

Table of Contents

		Page
I.	**Introduction**	1
II.	**Thoroughfare Plan**	5
	Major Thoroughfares	5
	Minor Thoroughfares	7
	Construction Priorities	13
III.	**Implementation**	19
	State and Municipal Adoption of the Thoroughfare Plan	19
	Subdivision Control	20
	Zoning	20
	Future Street Lines	20
	Capital Improvements Program	21
	Official Maps	21
	Urban Renewal	22
	Development Reviews	23
	Funding Sources	23
IV.	**Travel Deficiency Analysis of the Existing System**	25
	Existing Travel Patterns	25
	Traffic Accidents	26
	Bridge Conditions	29
	Traffic Capacity Analysis	31
V.	**Existing and Projected Conditions**	35
	Land Use	35
	Population Trends	36
	Economy and Employment	43
VI.	**Environmental Concerns**	45
	Wetlands	45
	Threatened and Endangered Species	45
	Historic Sites	46
	Archaelogical Sites	46
VII.	**Traffic Model Development**	49
	The Planning Area	49
	The Base Year Network	49
	Data Requirements	50
	Trip Generation	55
	Trip Distribution	58
	Mode Choice	59
	Trip Assignment	59
	Design Year Projections	61

		Page
Appendix A:	Thoroughfare Planning Principles	65
Appendix B:	Typical Thoroughfare Cross Sections	73
Appendix C:	Thoroughfare Plan Street Tabulations and Recommendations	79
Appendix D:	Planning Area Housing and Employment Data	85
Appendix E:	Recommended Subdivision Ordinances	93
Appendix F:	Public Involvement	103
Appendix G:	Glossary of Technical Terms	111

List of Figures

Figure		Page
1	Kings Mountain Location Map	3
2	1979 Thoroughfare Plan (unadopted)	9
3	1996 Thoroughfare Plan	11
4	Recommended Improvements	17
5	Level of Service	27
6	2020 Capacity Deficiencies	33
7	High Housing and Employment Growth	37
8	Land Development Plan	39
9	Persons per Dwelling Unit Trends	41
10	Population Trends	42
11	Employment Trends	43
12	Traffic Zone Map	51
13	Tranplan Network	53
14	Idealized Thoroughfare Plan	71
15	Typical Cross Sections	77

List of Tables

Table		Page
1	Probability Estimation Guide	13
2	Environmental Considerations	14
3	Cost Estimates - Benefits - and Probable Impacts	15
4	High Accident Intersections	29
5	Substandard Bridges	30
6	Population Trends and Projections	36
7	Cordon Station Summary	56
8	Trip Length Frequency Curve and Friction Factor Data	59
9	Actual vs. Generated Screenline Totals	60
10	Travel Model Input Variables	63
11	Travel Data Summary	63

I. Introduction

A well planned transportation system plays a vital role in our economy and way of life. It provides the means to transport people and goods from one place to another quickly and conveniently. A good highway system must not only meet existing travel demands, but must also keep pace with the development of the region. Recognizing the importance of such a system, in July of 1990, the City of Kings Mountain made a formal agreement with the Statewide Planning Branch of the North Carolina Department of Transportation to begin an update of the 1979 Kings Mountain Proposed Thoroughfare Plan. (This Plan was never formally adopted).

The City of Kings Mountain is located 38 miles west of Charlotte. It occupies both Cleveland and Gaston Counties with most of its city limits falling in Cleveland County as shown in **Figure 1.** Kings Mountain is served by five primary routes: I-85 and US 29 serve as a bypass to the southeast; US 74 accesses Gastonia to the east and Shelby to the west; US 74 Business serves as the main east-west route through the central business district; NC 161 connects Kings Mountain to Bessemer City to the north; and NC 216 bisects the planning area from north to south.

This report documents the findings of the Kings Mountain Thoroughfare Plan study and the resulting recommendations. The report includes recommendations for thoroughfare cross-sections, cost estimates and benefit evaluations for the recommended improvements, and recommendations for plan implementation. It is intended to serve as a reference for future transportation studies and a mutual guide between the City of Kings Mountain and the Department of Transportation for the implementation of the adopted thoroughfare plan.

The proposed system of thoroughfares was developed following the principles of thoroughfare planning outlined in **Appendix A** of this report. Since this is a mutually adopted plan, concessions and compromise slightly altered the technically recommended plan in favor of one that addressed economic, cultural, social, and environmental needs as well. These negotiations resulted in the mutual adoption of the Kings Mountain Thoroughfare Plan dated June 25, 1996, by the City of Kings Mountain on June 25, 1996, and by the North Carolina Board of Transportation (for the North Carolina Department of Transportation) on September 5, 1996.

It should be emphasized that the recommended plan (see **Figure 3, page 13**) is based on anticipated growth and development of the planning area as indicated by current trends. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific design requirements.

GEOGRAPHIC LOCATION

FOR

KINGS MOUNTAIN NORTH CAROLINA

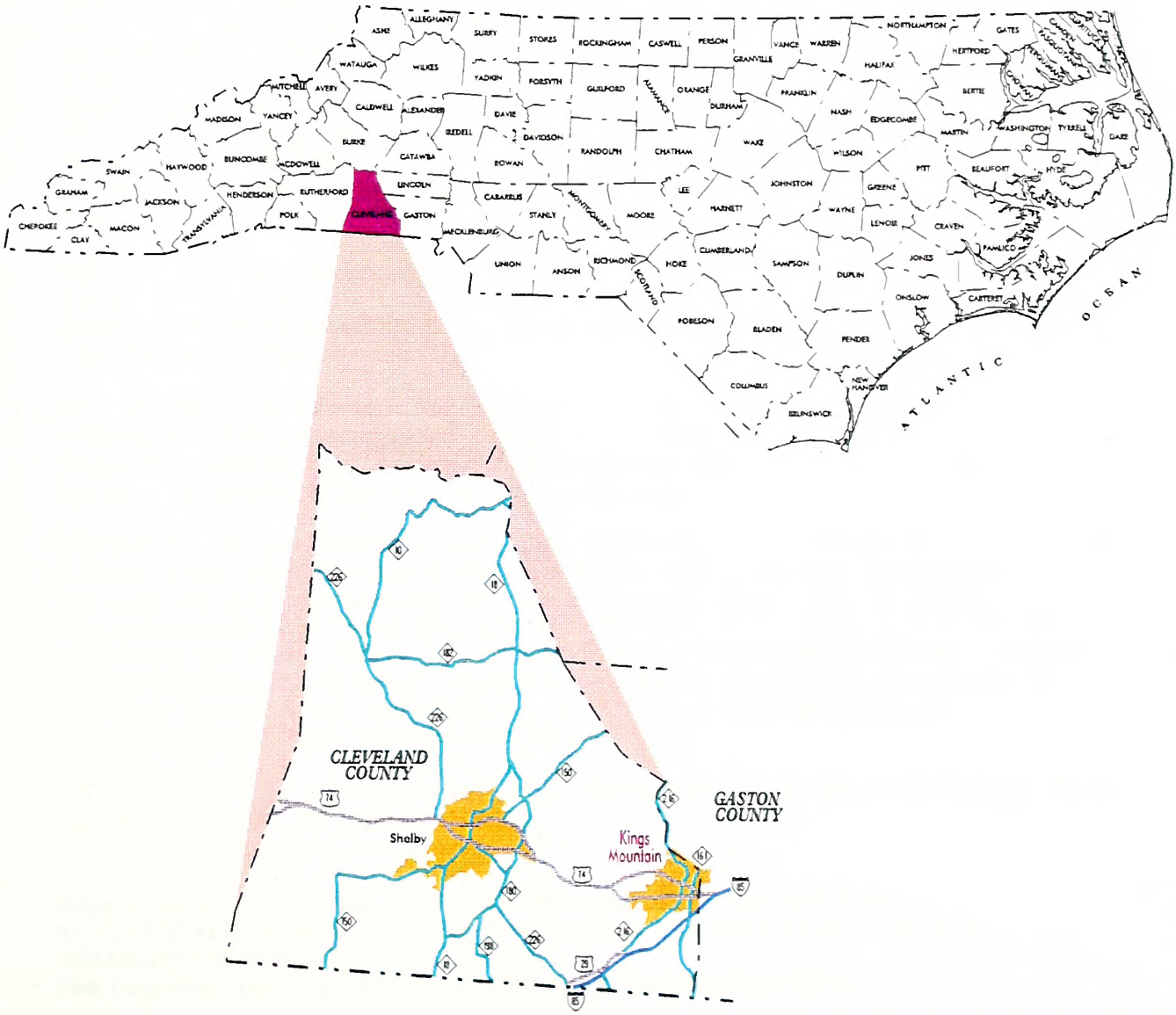


FIGURE 1

II. Thoroughfare Plan

In July of 1990, a formal agreement was made between the City of Kings Mountain and the Statewide Planning Branch of the North Carolina Department of Transportation to begin an update of the 1979 Kings Mountain Thoroughfare Plan (not adopted) (refer to **Figure 2**). The following is a summary of the 1996 Kings Mountain Thoroughfare Plan as shown in **Figure 3**. More detailed descriptions of each improvement and thoroughfare are given in **Appendices B and C**.

Major Thoroughfares

Recommended Improvements

I-85[3]: It is recommended that this facility be widened to eight lanes from the north-eastern planning area boundary (PAB) just past the separation of I-85/US 29 and US 74. It is also recommended that I-85 be widened to six lanes from this point to the south-western PAB. Extending the eight-lane cross-section just past the interchange will allow for safer traffic merging than changing from eight lanes to six lanes at the interchange. These recommendations have been coordinated with Statewide Planning's Gaston Urban Area Coordinator and with the Cleveland County Thoroughfare Plan recommendations.

US 74[3]: It is recommended that this facility be widened to six lanes from I-85 to the western PAB. This recommendation has been coordinated with the Shelby Thoroughfare Plan recommendations.

NC 161/NC 216 Connector[1]: It is recommended that a two-lane connector be constructed between NC 161 and NC 216. This will improve industrial access, as well as improve general traffic flow. A grade separation over the railroad tracks is preferred.

NC 161[2]: It is recommended that this facility be widened to four lanes from the southern PAB to I-85 and from the proposed NC 161/NC 216 connector to the northern PAB. It is also recommended that the section of NC 161 from I-85 to US 74 be widened to five lanes to accommodate turning movements. These improvements have been coordinated with Statewide Planning's Gaston Urban Area Coordinator and the Cleveland County Thoroughfare Plan recommendations.

NC 216[2]: It is recommended that this facility be widened to four lanes from US 74 to SR 2013.

[1] Same proposal as on the 1979 Kings Mountain Thoroughfare Plan
[2] Alignment and or cross-section revised from the 1979 Kings Mountain Thoroughfare Plan
[3] New proposal for the 1996 Kings Mountain Thoroughfare Plan

TIP R-2625*[2] *(Dixon School Road Extension): It is recommended that this funded facility be widened to four lanes from I-85 to US 74 Business later in the planning period. The cross-section recommended in the Draft Environmental Assessment (DEA) requires enough right-of-way to accommodate a multilane facility. It is also recommended that it be extended to intersect with NC 216 at SR 2013. A two-lane cross-section should be sufficient to handle traffic along this extension. An additional interchange with US 74 will need to be constructed in conjunction with the extension. This facility should then be signed as NC 216 Bypass.

Phifer Road[2]: It is recommended that this facility be widened to accommodate an exclusive right turn lane into the high school and into the middle school. The addition of this turn lane will reduce the congestion caused by school traffic.

Gold Street[2]: It is recommended that this facility be extended at the eastern end to connect with US 74 Business. This will require SR 1118 to be realigned to intersect with the extension of Gold Street. It is also recommended that the offset intersection of Gold Street at NC 216 be realigned. The extension of Gold Street will provide better access to the existing facility, and the realignment will create a more continuous route. Combined, these recommendations will help to reduce US 74 Business congestion that is increased by traffic traveling to Gold Street. The realignment will require construction of a new at grade railroad crossing.

Railroad Crossing Closings

The railroad corridor running through Kings Mountain is proposed to be a high speed rail corridor connecting Charlotte, NC to Atlanta, GA. The Railroad currently requires that a minimum of two at-grade crossings be closed for every one that is constructed along a high speed rail corridor. Therefore, before the Railroad will allow construction of a new at-grade crossing with Gold Street, several existing crossings must be closed. Although the City is aware of this requirement, they are not prepared at this time to make a commitment to close specific crossings.

[1] Same proposal as on the 1979 Kings Mountain Thoroughfare Plan
[2] Alignment and or cross-section revised from the 1979 Kings Mountain Thoroughfare Plan
[3] New proposal for the 1996 Kings Mountain Thoroughfare Plan

Other Major Thoroughfares

The following facilities carry high volumes of traffic within and through the planning area. These facilities will be adequate for traffic throughout the planning period.

Oak Grove Road (SR 2033)
Scism Road (SR 2033)
Oak Grove Road (SR 2026)
Waco Road (SR 2026)
Lake Montonia (SR 2292 and SR 1104)
Midway Road (SR 2245)
Pinnacle Road (SR 1125)

Minor Thoroughfares

Recommended Improvements

SR 2034[3]: The addition of an interchange with US 74, as mentioned above, will increase traffic along SR 2034. Therefore, it is recommended that this facility be widened to two 12 foot lanes to increase its capacity.

Other Minor Thoroughfares

The following facilities collect traffic from local access streets and carry it to major thoroughfares. These facilities will be adequate for traffic throughout the planning period.

Old Home Place (SR 2032)
Mountain Road (SR 1400)
Chestnut Ridge (SR 2020)
Margrace Road (SR 2263)
Mountain Street
Watterson Street
Battleground Avenue
Lewis Road (SR 1401)

Facilities Upgraded from the 1979 Thoroughfare Plan (not adopted)

Minor Thoroughfares

Scism Road (SR 2032)
Mountain Street

Note: Additional roads were upgraded due to expansion of the planning area boundary.

Deletions from the 1979 Thoroughfare Plan (not adopted)

- Southern extension of Cansler Street
- Phifer Road to Margrace Road (SR 2263) connector
- Bridges Street/Fairview Avenue connector

[1] Same proposal as on the 1979 Kings Mountain Thoroughfare Plan
[2] Alignment and or cross-section revised from the 1979 Kings Mountain Thoroughfare Plan
[3] New proposal for the 1996 Kings Mountain Thoroughfare Plan

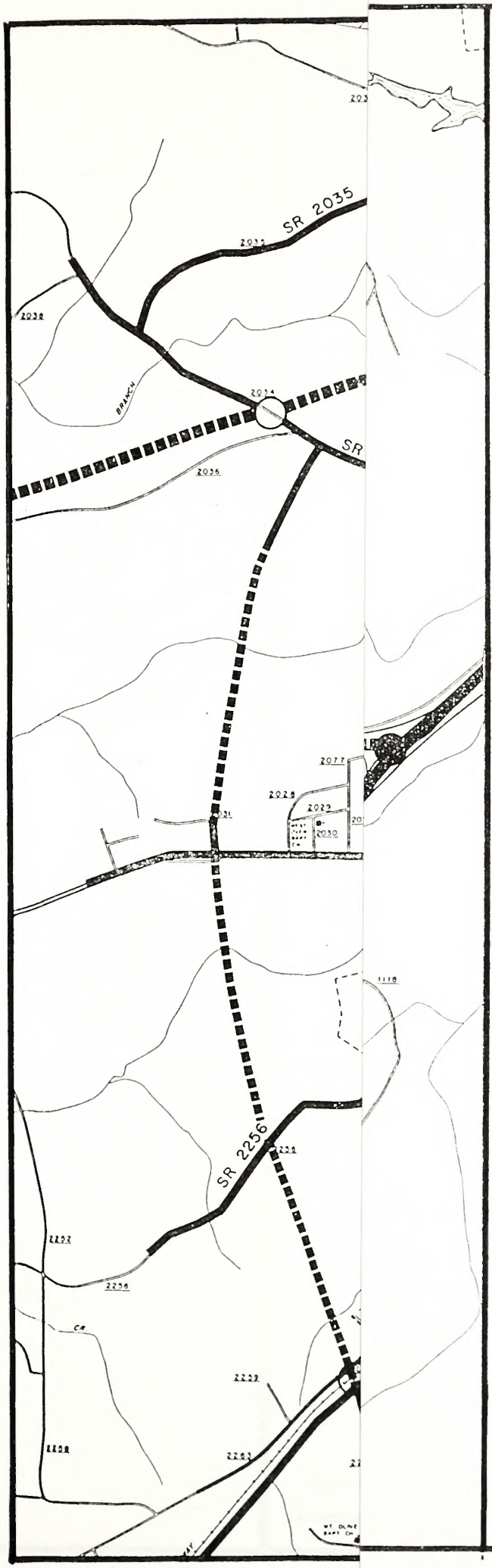


FIGURE 2

PROPOSED REVISED THOROUGHFARE PLAN

OCTOBER 17, 1979

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARES		
FREEWAY		
OTHER		
MINOR THOROUGHFARES		
INTERCHANGE		
GRADE SEPARATION		

ADOPTED BY CITY OF KINGS MOUNTAIN ON _____.

RECOMMENDED APPROVAL BY PLANNING AND RESEARCH BRANCH ON _____.

ADOPTED BY NORTH CAROLINA DEPARTMENT OF TRANSPORTATION ON _____.

PUBLIC HEARING ON _____.

N

S

KINGS MOUNTAIN

AND VICINITY

GASTON AND CLEVELAND COUNTIES

NORTH CAROLINA

SCALE

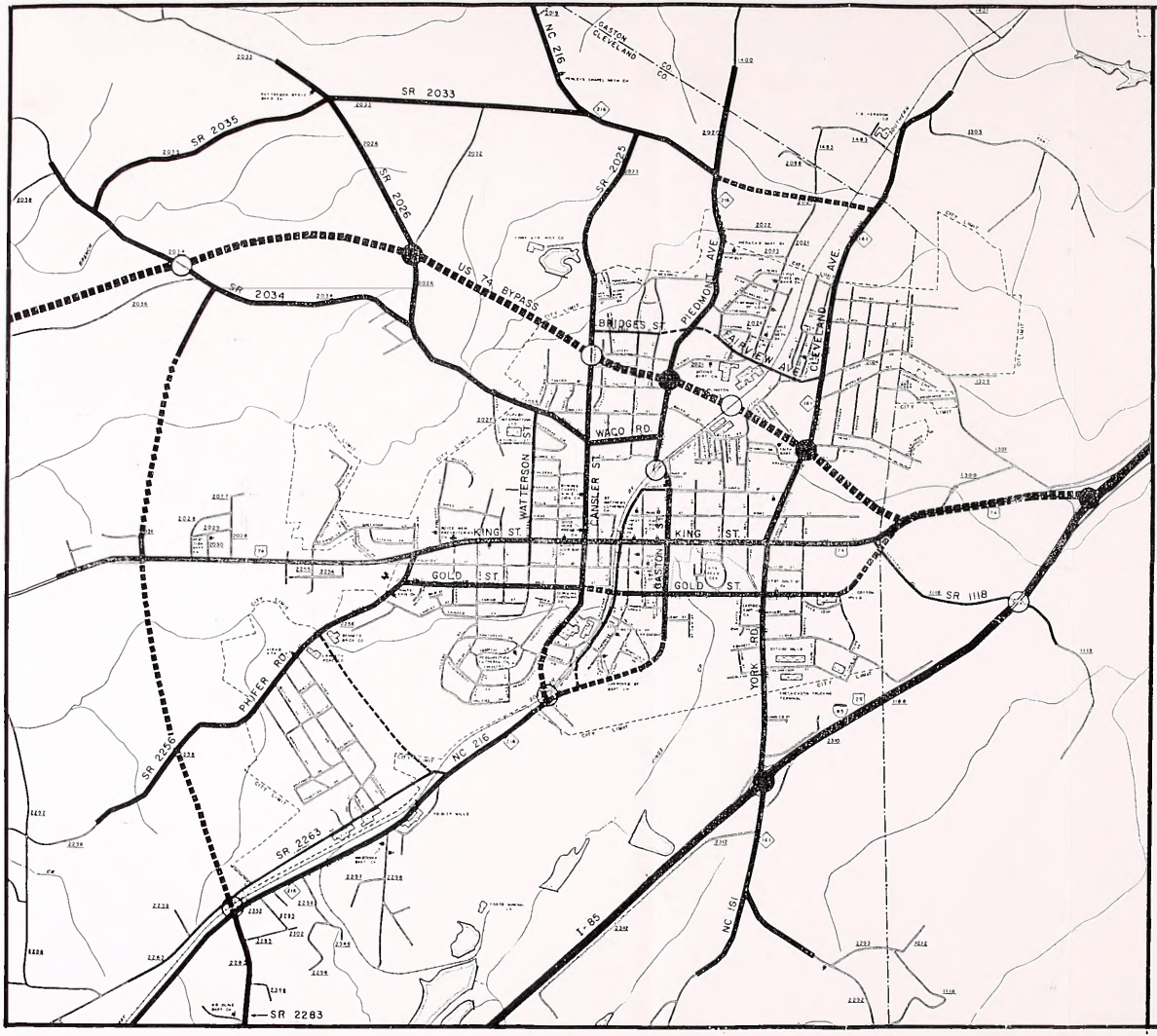


FIGURE 2

PROPOSED REVISED THOROUGHFARE PLAN

OCTOBER 17, 1979

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARES		
FREEWAY		
OTHER		
MINOR THOROUGHFARES		
INTERCHANGE		
GRADE SEPARATION		

ADOPTED BY CITY OF KINGS MOUNTAIN ON _____.

RECOMMENDED APPROVAL BY PLANNING AND RESEARCH BRANCH ON _____.

ADOPTED BY NORTH CAROLINA DEPARTMENT OF TRANSPORTATION ON _____.

PUBLIC HEARING ON _____.

N

S

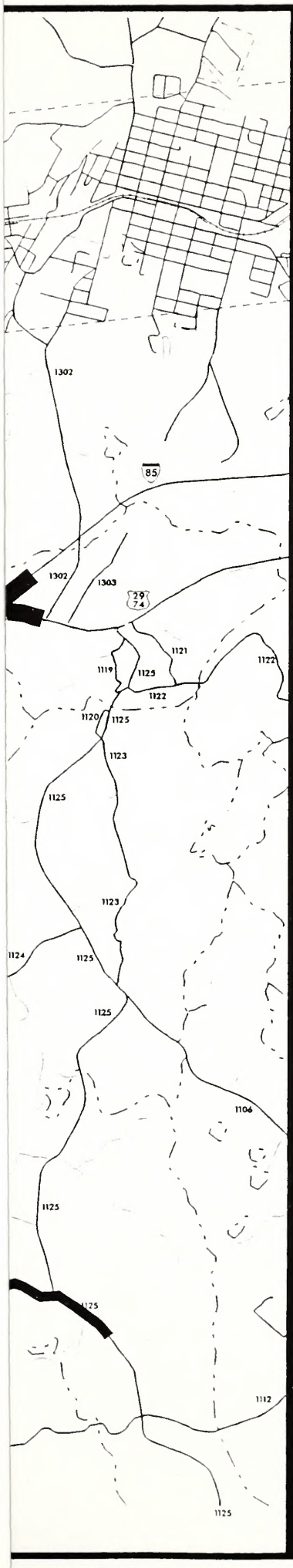
KINGS MOUNTAIN

AND VICINITY

GASTON AND CLEVELAND COUNTIES

NORTH CAROLINA

SCALE



LEGEND

	EXISTING	PROPOSED
INTERSTATE /FREEWAY		
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		
INTERCHANGE		
GRADE SEPARATION		

ADOPTED BY:

CITY OF KINGS MOUNTAIN	*June 25, 1996*
PUBLIC HEARINGS	*June 25, 1996*
RECOMMENDED BY STATEWIDE PLANNING	*M. R. Poole* *August 2, 1996*
NC DEPARTMENT OF TRANSPORTATION	*September 5, 1996*

FIGURE 3

THOROUGHFARE PLAN

KINGS MOUNTAIN

June 25, 1996

CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 2 3 kilometers

0 1 2 miles

LEGEND

	EXISTING	PROPOSED
INTERSTATE FREEWAY		
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		
INTERCHANGE		
GRADE SEPARATION		

ADOPTED BY:

CITY OF KINGS MOUNTAIN PUBLIC HEARINGS	June 25, 1996 June 25, 1996
RECOMMENDED BY STATEWIDE PLANNING	M. R. Poole August 2, 1996
NC DEPARTMENT OF TRANSPORTATION	September 5, 1996

FIGURE 3

THOROUGHFARE PLAN

KINGS MOUNTAIN

June 25, 1996

CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 2 3 kilometers

0 1 2 miles

Construction Priorities, User Benefits, and Cost Estimates

The recommended improvements (refer to **Figure 4**) in this thoroughfare plan report cannot be undertaken all at once, nor should they be. The need for projects is based on traffic projections for a twenty-one year design period. Therefore, projects must be prioritized for realistic scheduling to be possible. In an effort to provide a common denominator to compare various improvement projects in the recommended Kings Mountain Thoroughfare Plan, an assessment has been made of the benefits that can be expected from the thoroughfare projects. These benefits and associated project costs are then used along with local input as a guide in prioritizing projects.

Three principal measures were used to estimate the benefits that would be derived from each project: road user cost savings; the potential for increased economic development resulting from the improvement; and the environmental impacts, both positive and negative, which may result. The first measure is an actual estimate of dollar savings, while the others are estimates of the probability of the resulting change. These measures are described below.

Reduced road user costs should result from any roadway improvement, from simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and proposed facility have been made in terms of vehicle operating costs, travel time costs, and accident costs. These user benefits are computed as total dollar savings over the twenty-one year design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is denoted as the probability that it will stimulate the economic development of an area by providing access to land with development potential and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability is rated on a scale from 0 (none) to 1.00 (excellent), along with the following intermediate levels:

Table 1. Probability Estimation Guide

Subjective Evaluation	Impact Probability
Excellent - very substantial	1.00
Very good - substantial	0.75
Good - considerable	0.50
Fair - some	0.25
Poor - none	0.00

The environmental impact analysis considers the effect of a project on the physical, social and cultural, and economic environment. Many of these have been accounted for in the evaluation of the project with respect to user benefits, cost, and economic development potential. However, there are twelve environmental factors generally not considered in these evaluations. They are the environmental impacts of a project on: (1) air quality; (2) water resources; (3) soils and geology; (4) wildlife; (5) vegetation; (6) housing and neighborhoods; (7) noise; (8) educational facilities; (9) churches; (10) parks and recreational facilities; (11) historic sites; and (12) public health and safety. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impact of a project.

Table 2. Environmental Considerations

Physical Soils and Geology	Social/Cultural Environment	Economic Environment
Air Quality	Housing and Neighborhoods	Businesses
Water Resources	Noise	Employment
Soils and Geology	Educational Facilities	Economic Development
Wildlife	Churches	Public Utilities
Vegetation	Parks and Recreational Facilities	Transportation Costs
	Historic Sites and Landmarks	Capital Costs
	Public Health and Safety	Operation and Maintenance Costs
	National Defense	
	Aesthetics	

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its projected benefits, might prove to be unjustified due to the excessive costs involved in construction. The highway costs estimated in this report are based on the average statewide construction costs for similar project types. An estimate of anticipated right-of-way costs is also included. **Table 3**

evaluates the proposed Kings Mountain improvements with respect to user benefits, estimated costs, probability of economic development, and environmental impact.

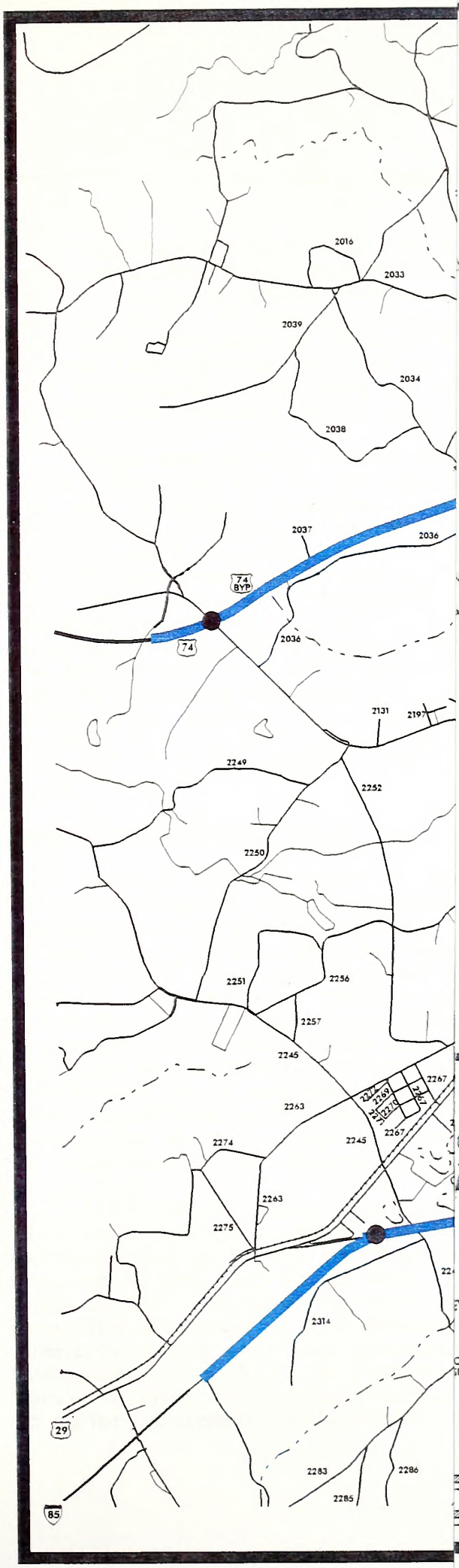
To guide both the State and the local municipality in their efforts to implement the improvements recommended in this report, the proposed projects have been placed in order of priority (refer to **Table 3**). These projects have been grouped based on benefits and associated project costs.

Table 3. Kings Mountain Thoroughfare Plan
Cost Estimates - Benefits - and Probable Impacts

Description	Const. Cost $1000	ROW Cost $1000	Total Cost $1000	User Benefits $1000	Economic Development	Environmental Impacts	
						Positive	Negative
Group 1							
I-85 Widening	28880	220	29100	108076	0.50	0.50	0.40
NC 161/NC 216 Connector	1632	368	2400	47022	0.25	0.50	0.10
TIP R-2625 Extension (from US 74 Business to US 74)	1978	322	2300	43920	0.75	0.75	0.40
Phifer Road Widening	800	0	800	*	0.10	0.75	0.10
Group 2							
NC 161 Widening (from US 74 to I-85)	1160	40	1200	19154	0.25	0.50	0.25
TIP R-2625 Extension (from US 74 to NC 216)	2496	504	3000	68591	0.75	0.75	0.40
NC 161 Widening (from NPAB to NC 161/NC 216 Connector)	1091	9	1100	3397	0.40	0.50	0.40
NC 216 Widening	2515	105	2700	5354	0.40	0.50	0.40
Group 3							
TIP R-2625 Widening	2400	0	2400	2352	0.40	0.50	0.10
US 74 Widening	18584	16	18600	24948	0.50	0.50	0.25
Gold Street Realignment and Extension	530	170	700	**	0.50	0.50	0.10
NC 161 Widening (from I-85 to SPAB)	2498	2	2500	6065	0.40	0.50	0.10

* This project is necessary to handle peak hour congestion due to school traffic. Therefore, benefits were not estimated.

** This project will provide connectivity and industrial access.



LEGEND

	WIDENING	NEW FACILITY
ANES		

	EXISTING	PROPOSED
NGE		
PARATION		

FIGURE 4

COMMENDED PROVEMENTS

KINGS MOUNTAIN

June 25, 1996

EVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY

ORTH CAROLINA DEPARTMENT OF TRANSPORTATION
SION OF HIGHWAYS – STATEWIDE PLANNING BRANCH

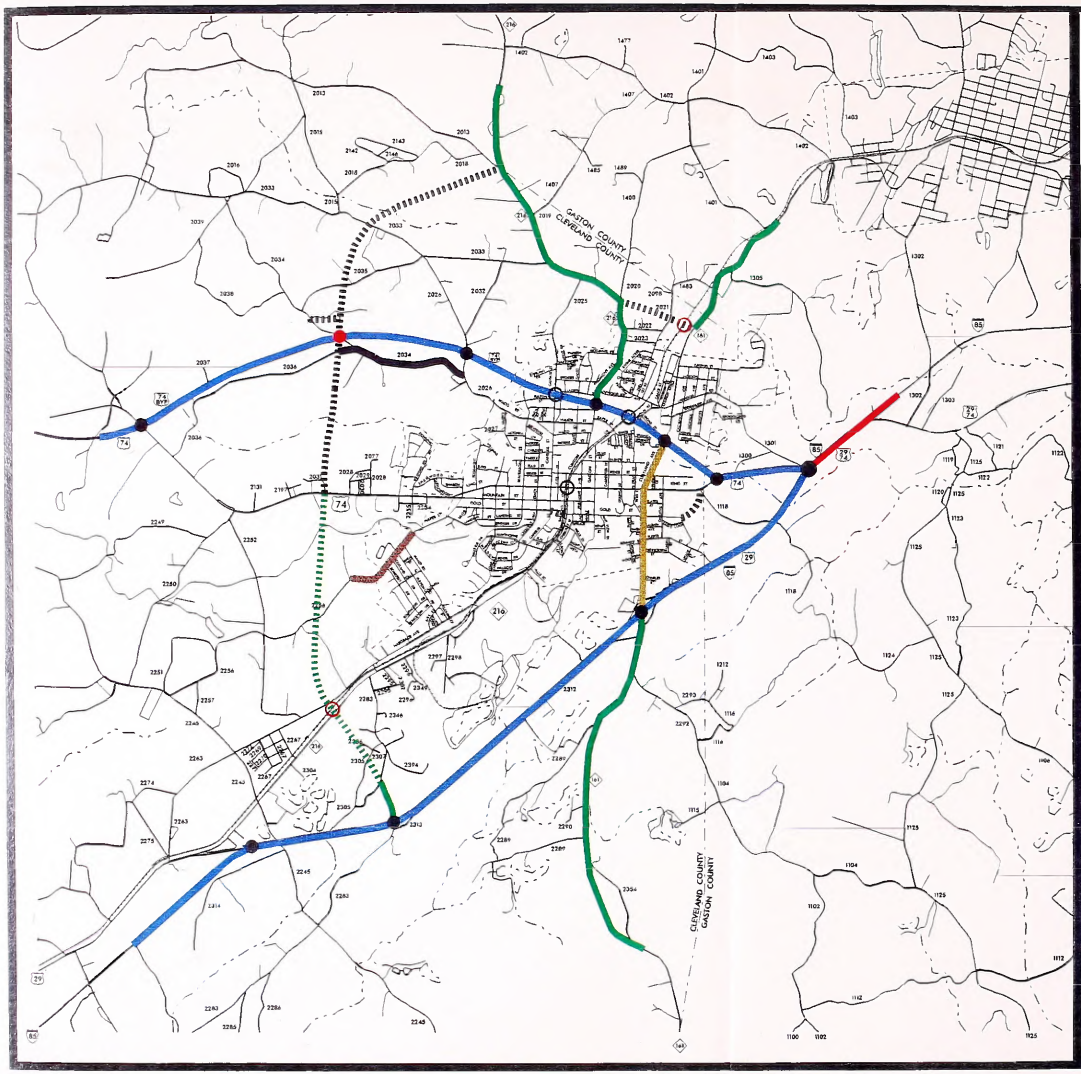
IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

1 2 3 kilometers

1 2 miles



LEGEND

# OF 12 FT LANES	WIDENING	NEW FACILITY
2 LANES		
3 LANES		
4 LANES		
5 LANES		
6 LANES		
8 LANES		

	EXISTING	PROPOSED
INTERCHANGE	●	●
GRADE SEPARATION	○	○

FIGURE 4

RECOMMENDED IMPROVEMENTS

KINGS MOUNTAIN

June 25, 1996

CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 2 3 kilometers

0 1 2 miles

III. Implementation

Implementation is one of the most important aspects of the transportation plan. Unless implementation is an integral part of the process, the effort and expense associated with developing a plan is lost. To neglect the implementation process is a three-fold loss: the loss of the capital expenditures used in developing a plan; the opportunity cost of the capital expenditures; and, most importantly, the loss of the benefits which would accrue from an improved transportation system.

There are several administration controls and implementation tools which can aid in the implementation of a thoroughfare plan. They are generally mandated through Federal and State Legislation. They include: Mutual Adoption of the Thoroughfare Plan; Subdivision Regulations; Zoning Ordinances; Future Street Lines; Capital Improvements Programs; Official Maps; Urban Renewal; and Development Reviews. Generally, two issues play a major role in the implementation process -- available finances and citizen involvement. Effective use of the controls and tools listed above are indicative of good planning and minimize the effects of limited finances and negative citizen reaction to specific elements of a plan. It is through good planning that maximum use is made of every available dollar and that citizen involvement and approval of the transportation plan is obtained.

State and Municipal Adoption of the Thoroughfare Plan

Chapter 136, Article 3A, Section 136-66.2 of the General Statutes of North Carolina provides that after development of a thoroughfare plan, the plan may be adopted by the governing body of the municipality and the Department of Transportation to serve as the basis for future street and highway improvements. The General Statutes also require that, as part of the plan, the governing body of the municipality and the Department of Transportation shall reach agreement on responsibilities for existing and proposed streets and highways included in the plan. Facilities which are designated as a State responsibility will be constructed and maintained by the Division of Highways. Facilities which are designated as a municipal responsibility will be constructed and maintained by the municipality.

After mutual plan adoption, the Department of Transportation will initiate negotiations leading to determining which of the existing and proposed thoroughfares will be a Department responsibility and which will be a municipal responsibility. Chapter 136, Article 3A, Section 136-66.1 of the General Statutes provides guidance in the delineation of responsibilities. In summary, these statutes provide that the Department of Transportation shall be responsible for those facilities which serve volumes of through-traffic and traffic from outside the area to major business, industrial, governmental, and institutional

destinations located inside the municipality. The municipality is responsible for those facilities which serve primarily internal travel.

Subdivision Control

A subdivision ordinance requires that every subdivider submit to the City Planning Commission a plot of his or her proposed subdivision. Certain standards must be met by the developer before he or she can be issued a building permit to construct the development. Through this process, it is possible to reserve or protect the necessary right-of-way for proposed streets which are a part of the thoroughfare plan and to require street construction in accordance with the plan.

This tool would be applicable to the proposed NC 161/NC 216 connector, the proposed extension of Gold Street, the proposed realignment of NC 216 with Gaston Street, and the extension of TIP R-2625 (Dixon School Road Extension) to US 74. Requiring set-backs would reduce the disruption of homes and businesses due to the construction of new facilities.

Zoning Ordinances

A zoning ordinance can be beneficial to thoroughfare planning by designating appropriate locations for various land uses and allowable densities of residential development. This provides a degree of stability on which to make future traffic projections and to plan streets and highways.

Other benefits of a good zoning ordinance are: (1) the establishment of standards of development which will aid traffic operations on major thoroughfares; and (2) the minimization of strip commercial development which creates traffic friction and increases the traffic accident potential.

The City's zoning ordinances should be structured to control strip development along the thoroughfares. Particular attention should be paid to US 74 Business and TIP R-2625 (Dixon School Road Extension). US 74 Business already has a good deal of strip development. Continuing to allow this type of development without strict zoning controls will increase traffic congestion on the facility. Strip development should also be controlled along TIP R-2625. If this type of development is allowed, TIP R-2625 (Dixon School Road Extension) will not be able to maintain its intended capacity.

Future Street Lines

The Future Street Line Ordinance is beneficial where the widening of a street will be necessary at some time in the future.

A municipality, with legislative approval, may amend its charter to be empowered to adopt future street line ordinances. Through a metes-and-bounds description of a street's future right-of-way requirements, the Town may prohibit new construction or reconstruction of structures within the future right-of-way. This approach requires specific design of a facility and would usually require surveys and public hearings to let affected property owners to know what to expect and to allow them to make necessary adjustments without undue hardships. A specific ordinance can be enacted for several streets.

This tool would be applicable to the recommended widening of I-85, US 74, NC 161, NC 216, and Phifer Road.

Recommended right-of-way and street cross-sections for these thoroughfares are given in Appendix C.

Capital Improvements Program

One of the tools which makes it easier to build a planned thoroughfare system is a Capital Improvements Program. This is a long range budget for street improvements, acquisition of right-of-way, and other capital improvements on the basis of projected revenues. Municipal funds should be available for: construction of street improvements which are a municipal responsibility; right-of-way cost sharing on facilities designated a Division of Highways responsibility; and advance purchase of right-of-way where such action is warranted.

Historically, cities and towns have depended a great deal on Federal or State funding to solve their transportation problems. Chapter 136, Article 3A, of the Road and Highway Laws of North Carolina clearly outlines the responsibilities and obligations of the various govermental bodies regarding highway improvements. Highway Bill 1211, passed in 1988, limits the role of municipalities to specific limits in right-of-way cost sharing. Set-back regulations, right-of-way dedications, and reservations play a major role in the ultimate cost of many facilities. Only in special cases will the municipality be able to enjoy the benefits of highway improvement without some form of investment.

This report should provide a basis on which the City of Kings Mountain can develop their Capital Improvements Program.

Official Maps

The Roadway Corridor Official Map (or Official Street Map) is a document, adopted by the legislative body of the community, that pinpoints and preserves the location of proposed streets against encroachment. In effect, the official map serves notice on developers that the State or municipality intends to acquire certain property. The official map serves as a positive influence for sound development by reserving sites for public improvements

in anticipation of actual need.

The North Carolina Department of Transportation (NCDOT) limits the use of official maps to large scale, fully access controlled facilities planned for rapidly developing areas outside of municipal jurisdictions. For projects within municipal jurisdictions, official maps should be prepared and adopted by the local government. A municipality may adopt official maps that extend beyond its extraterritorial jurisdiction with approval from the County Board of Commissioners.

It should be recognized that an official map places severe but temporary restrictions on private property rights. These restrictions are in the form of a prohibition, for up to three years, on the issuance of building permits or the approval of subdivisions on property lying within an official map alignment. The three year reservation period begins with the request for development approval. This authority should be used carefully and only in cases where less restrictive powers are found to be ineffective.

The general statute establishing the Official Street Map authority is fairly explicit in outlining the procedures to be followed and the types of projects to be considered. As required by the statute, a project being considered for an Official Street Map must be programmed in the State's Transportation Improvement Program (TIP) **or** included in a locally adopted Capital Improvements Program in addition to appearing on the adopted street system plan. The statute states that the Capital Improvements Program must be for a period of ten years or less and must identify the estimated cost of acquisition and construction of the proposed project as well as the anticipated financing.

The Program Development Branch of the North Carolina Department of Transportation is responsible for facilitating the adoption of Official Street Maps. Cities considering Official Street Map projects should contact this Branch for a copy of "Guidelines for Municipalities Considering Adoption of Roadway Corridor Maps" at:

NC Department of Transportation
Program Development Branch
Post Office Box 25210
Raleigh, NC 27611

Urban Renewal

Urban renewal plays a minor role in the transportation planning implementation process in terms of scope and general influence. However, under the right circumstances, renewal programs can make significant contributions. Provisions of the New Housing Act of 1974 (as amended) call for the conservation of slum areas. In the course of renewal, it is important to

coordinate with the Thoroughfare Plan to see if additional set-backs or dedication of rights-of-way are needed.

Continued use of urban renewal programs to improve the transportation system is encouraged. Changes that can be made under this program are generally not controversial or disruptive compared to the clearance of a significant area.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation prior to access being permitted. Any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, large industries, etc.) may be comprehensively studied by staff from the Traffic Engineering, Statewide Planning, and Highway Design Branches of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility at minimal expense. Since the municipality is the first point of contact for developers, it is important that the municipality advise them of this review requirement and cooperate in the review process.

This review process would be beneficial for all of Kings Mountain's thoroughfares.

Funding Sources

The final step in the implementation process is to obtain funding for each project. Listed below are several examples of funding sources available to the municipality.

1. Access user impact fees to fund transportation projects. These fees, called "facility fees" in the legislation, are to be based upon "reasonable and uniform considerations of capital costs to be incurred by the town as a result of new construction. The facility fee must bear a direct relationship to additional or expanded public capital costs of the community service facilities to be rendered for the inhabitants, occupants of the new construction, or those associated with the development process."

2. Enact a bond issue to fund street improvements.

3. Continue to work with NCDOT to have local projects included in the Transportation Improvement Program (TIP).

4. Consider the possibility of specific projects qualifying for federal demonstration project funds.

6. Charge a special assessment for utilities; for example, increase water and sewer bills to cover the cost of street improvements.

7. Lobby for the use of Small Urban and Discretionary Funds. These are funds that the Board of Transportation Member may use at his or her discretion for area road projects.

8. Request federal assistance through the U. S. Department of Housing and Urban Development, including Community Revitalization Block Grants (which can be used to construct local streets), and Economic Development Grants.

9. Apply for grants and loans for public works and development facilities from other Federal agencies, for example, Small Business Development, etc.

IV. Travel Deficiency Analysis of Existing System

Existing Travel Patterns

A good indication of the adequacy of the existing major street system is a comparison of the traffic volumes with the ability of the streets to move traffic freely at a desirable speed. The ability of a street to move traffic freely, safely, and efficiently with minimum delay is mainly controlled by the spacing of major devices used. Therefore, the ability of a street to move traffic can be increased by restricting parking and turning movements, using proper sign and signal devices, and by the application of other traffic engineering techniques.

Capacity is defined as the maximum number of vehicles which has a reasonable expectation of passing over a given section of a roadway in one direction, or in both directions, during a given time period under prevailing roadway and traffic conditions.[1] The relationship of traffic volumes to the capacity of the roadway will determine the level of service (LOS) being provided. Six levels of service have been selected to identify the conditions existing under various speed and volume conditions on a highway or street. The six levels of service, as shown in **Figure 5,** are:

1. Level-of-service A (LOS A) represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

2. Level-of-service B (LOS B) is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A, because the presence of others in the traffic stream begins to affect individual behavior.

3. Level-of-service C (LOS C) is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others. Driver and pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns. Maneuvering within the traffic stream

[1] Highway Capacity Manual, Special Report 209, 1985, pp. 1-3.

requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

4. Level-of-service D (LOS D) represents high-density, but stable flow. Speed and freedom to maneuver are severely restricted. The driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

5. Level-of-service E (LOS E) represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Maneuvering within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers.

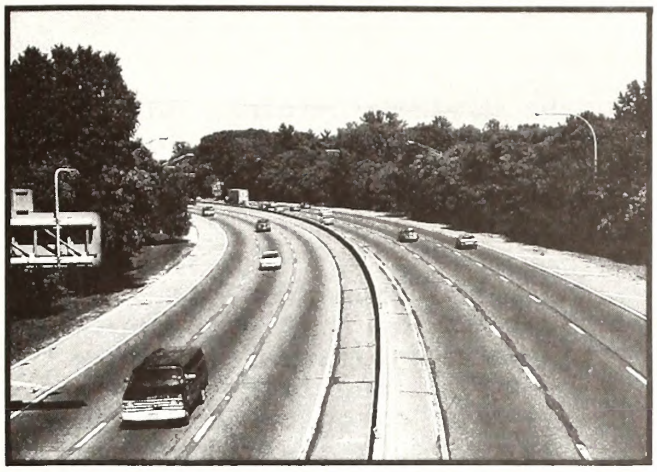
6. Level-of-service F (LOS F) is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. In many cases operating conditions of vehicles or pedestrians discharged from the queue may be quite good. It is the point at which arrival flow exceeds discharge flow which causes the queue to form. Level-of-service F is an appropriate designation for such points.

The recommended improvements and overall design of the Thoroughfare Plan were based on achieving a minimum of LOS D on existing facilities, and LOS C on new facilities. **LOS D** is considered the **"practical capacity"** of a facility, or the point at which the public begins to express dissatisfaction.

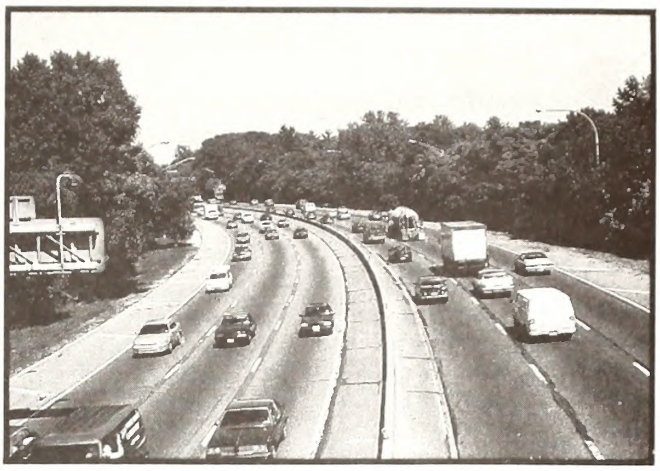
Traffic Accidents

Traffic accident analysis is an important consideration in the development of a thoroughfare plan. The source of traffic accidents can be broken down into three general categories: the physical environment, the driver, and the physical attributes of the vehicle. The first source includes such things as road conditions, road obstructions, traffic conditions, and the weather. The second source refers to the driver's mental alertness, distractions in the car, ability to handle the car, and reaction time. The third source includes such things as the size

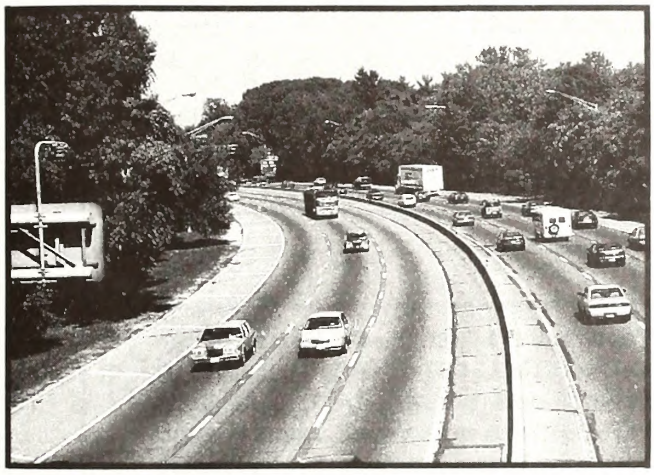
Source: 1994 Highway Capacity Manual



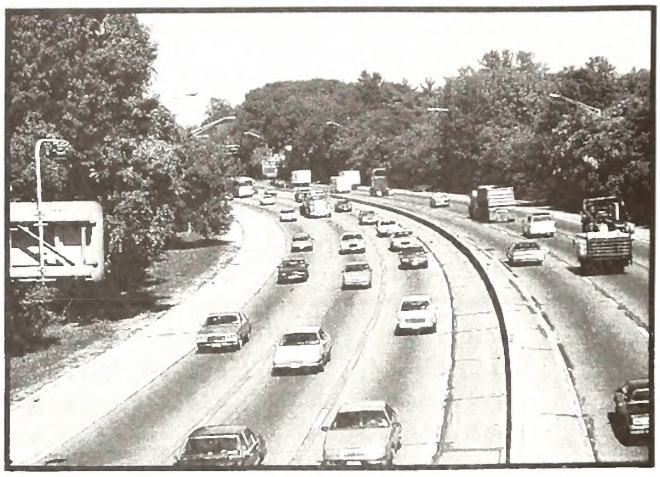
LOS A.



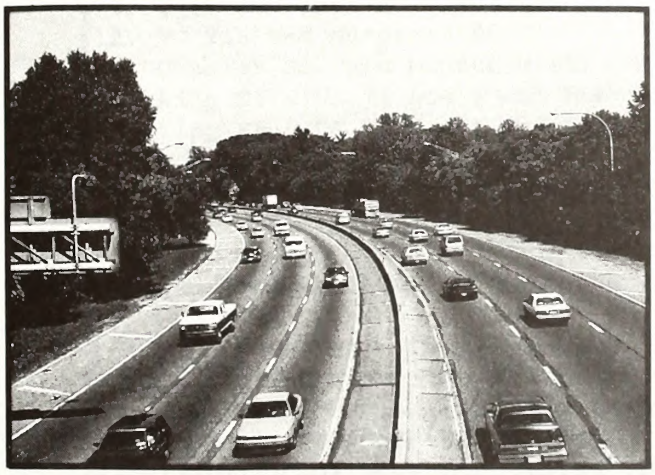
LOS D.



LOS B.



LOS E.



LOS C.

LOS F.

FIGURE 5

LEVELS OF SERVICE

of the vehicle, vehicle responsiveness, the condition of the brakes and the tires, and how well the windshield wipers and the defroster work. All traffic accidents can be attributed to one or more of these sources; however, the driver is often the primary source.

Accident data for January, 1988, to December, 1990, was studied as part of the development of this report. The largest single intersection accident site was found to be the intersection of US 74 Business and US 74 Bypass. Fifteen other intersections were also found to have ten or more accidents. Half of the accidents were found to be rear end accidents.

The four highest accident intersections are located along US 74 Business (King Street). These accidents can be attributed to congestion along the facility. The recommended extension and realignment of Gold Street will help reduce this congestion. This recommendation will improve travel along King Street by reducing the amount of Gold Street traffic that currently travels King Street.

Table 4. High Accident Intersections (January 1988 to December 1990)

Description	No.	Predominant Type
1. US 74 Bypass and US 74 Business	59	Rear End
2. Battleground Rd. (NC 216) and King St. (US 74 Bus.)	16	Left Turn
3. King St. (US 74 Bus.) and Cleveland Ave. (NC 161)	15	Rear End
4. Cansler St. and King St. (US 74 Bus.)	14	Rear End
5. Cansler St. and Walker St.	13	Angle
6. Country Club Rd. and King St. (US 74 Bus.)	12	Left Turn
7. King St. and (US 74 Bus.) and Sims St.	12	Rear End
8. King St. (US 74 Bus.) and York Rd. (NC 161)	12	Left Turn
9. Battleground Rd. (NC 216) and Mountain St.	11	Backing
10. Gold St. and York Rd. (NC 161)	11	Angle
11. I-85 and York Rd. (NC 161)	10	Left Turn
12. NC 216 and Margrace Rd.	10	Rear End
13. Cansler St. and Mountain St.	10	Angle
14. King St. (US 74 Bus.) and Mountain St.	10	Angle
15. King St. (US 74 Bus.) and Watterson St.	10	Angle
16. Mountain St. and Phifer Rd.	10	Angle

Bridge Conditions

Bridges are an important element of a highway system. Bridges represent the highest single cost of all elements of the system. Any deficiency in a bridge affects the efficiency of the entire transportation system. Bridges also present the greatest opportunity of all potential highway failures for disruption of

community welfare and for loss of life. It is therefore imperative that bridges be constructed to the same, or higher, design standards as the system surrounding them.

Congress enacted the National Bridge Inspection Standards on April 27, 1971, implementing the Federal Highway Act of 1968. The Standards require that all structures defined as bridges located on any of the Federal-Aid Highway Systems be inspected and that the safe load carrying capacity be computed at regular intervals, not to exceed two years. A sufficiency index number has been calculated for each bridge for the purpose of establishing eligibility and priority for replacement. The bridges with the highest priority are replaced as Federal-Aid funds and State funds become available.

A sufficiency rating is used in the analysis of bridges to help determine if a particular bridge is substandard. The sufficiency rating is a method of evaluating factors which are indicative of a bridge's ability to remain in service. These factors include structural adequacy and safety, serviceability and functional obsolescence, essentiality for public use, type of structure, and traffic safety features. This procedure results in a percentage in which 100% represents an entirely sufficient bridge and zero percent represents an entirely deficient bridge. A sufficiency rating of 50% or less qualifies for Federal Bridge Replacement Funds.

Substandard bridges are broken into two categories: structurally deficient bridges and functionally obsolete bridges. Structurally deficient bridges are in relatively poor condition or have insufficient load carrying capacity. Functionally obsolete bridges are narrow, have inadequate underclearances, have insufficient load carrying capacity, or are poorly aligned with the roadway and can no longer adequately serve today's traffic.

Table 5 (a) and **(b)** list substandard bridges located on routes included in the Kings Mountain Thoroughfare Plan.

Table 5(a). Structurally Deficient Bridges

Description	Sufficiency Rating
1. NC 161 over I-85 and US 29	62.8
2. SR 2036 over Potts Creek	37.8
3. SR 2283 over I-85	83.5

Table 5(b). Functionally Obsolete Bridges	
Description	Sufficiency Rating
4. US 29 NBL over I-85 SBL	77.0
5. SR 2245 over I-85	64.6
6. SR 2250 over Beasons Creek	77.7
7. US 74 Bus. over Southern RR	51.4
8. US 74 WBL over NC 161	94.0

Traffic Capacity Analysis

1990 Analysis

The North Carolina Department of Transportation conducts traffic counts on a regular basis across the state. These counts are reported in the form of Annual Average Daily Traffic (AADT) volumes. Additional traffic counts were taken in July of 1990 for the Kings Mountain Thoroughare Plan study. The comparison of these 1990 traffic volumes in Kings Mountain with the current street capacities indicates that I-85/US 74 is approaching capacity (Traffic Volume = 46,000; Capacity = 54,000), and the section of US 74 Business between NC 161 and Cansler Street is approaching capacity (Traffic Volume = 9,800; Capacity = 12,000).

"No Build" Alternative

If a "no build" alternative is taken, additional streets will reach capacity by the design year (2020), as well as the level of service of the streets described above continuing to deteriorate (refer to **Figure 6**).

- ***I-85***: The current capacity of this four-lane freeway is 54,000 vehicles per day (vpd). This facility will be over capacity by the design year. I-85 is projected to carry volumes ranging from 59,000 vpd at the south-western planning area boundary (PAB) to 106,000 vpd at the north-eastern PAB.

- ***US 74***: The current capacity of this four-lane freeway is 54,000 vpd. The sections of US 74 from I-85 to US 74 Business, NC 161 to NC 216, and US 74 Business to the western PAB will all be approaching capacity by the year 2020. These sections will be carrying volumes ranging from 46,200 vpd to 52,000 vpd.

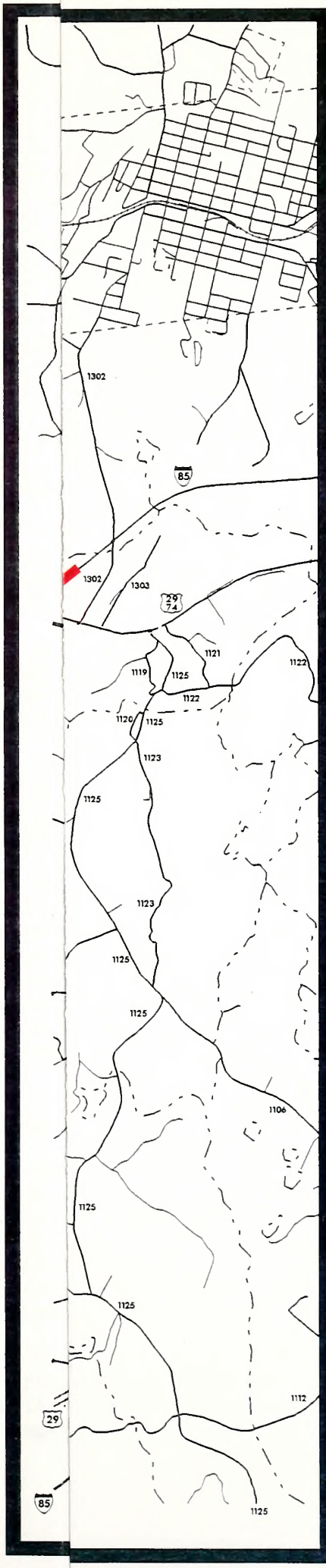
- ***US 74 Business***: The section of this facility from US 74 to Mountain Street is currently three lanes with a capacity of 14,000 vpd. The section of US 74 Business from US 74 to Cansler Street is projected to be over capacity by the design year with 16,000 vpd.

- ***NC 161***: NC 161 is currently two and three lanes through the Kings Mountain planning area. Its capacity ranges from 12,000 vpd to 14,000 vpd. The section from SR 2292 to US 74 will be over capacity by the year 2020 with volumes ranging from 15,000 vpd to 24,700 vpd. The remainder of NC 161 will be approaching capacity with volumes ranging from 10,300 vpd to 11,600 vpd.

- ***NC 216***: NC 216 is currently a two-lane facility with a capacity of 12,000 vpd. The sections of this facility from US 74 to SR 2020 and SR 2019 to SR 2018 will be approaching capacity with volumes of 10,400 vpd and 10,700 vpd, respectively. The section from Cansler Street to SR 2019 is projected to be over capacity with 16,000 vpd.

- ***SR 2026***: This narrow, two-lane facility has a current capacity of 9,000 vpd. SR 2026 is projected to carry 10,000 vpd by the design year.

- ***TIP R-2625 (Dixon School Road Extension)***: This proposed facility is funded in the *Transportation Improvement Program - 1996-2002*. The project is in the final planning stages. The Draft Environmental Assessment recommends a two-lane cross-section with right-of-way to accommodate a multilane facility. The two-lane facility will have a capacity of 12,000 vpd. Traffic projections indicate that the section from I-85 to Phifer Street will be approaching capacity by the year 2020. It is projected to carry 10,500 vpd.



N

S

LEGEND

2020 TRAFFIC VOLUMES	00,000
EXISTING & COMMITTED CAPACITY	00,000
AT OR OVER CAPACITY (V/C ≥ 1.00)	
NEAR CAPACITY (0.8 ≤ V/C < 1.00)	
TIP R-2625	
TIP (NEAR CAPACITY)	

FIGURE 6

2020 CAPACITY DEFICIENCIES

KINGS MOUNTAIN

June 25, 1996

CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 2 3 kilometers

0 1 2 miles

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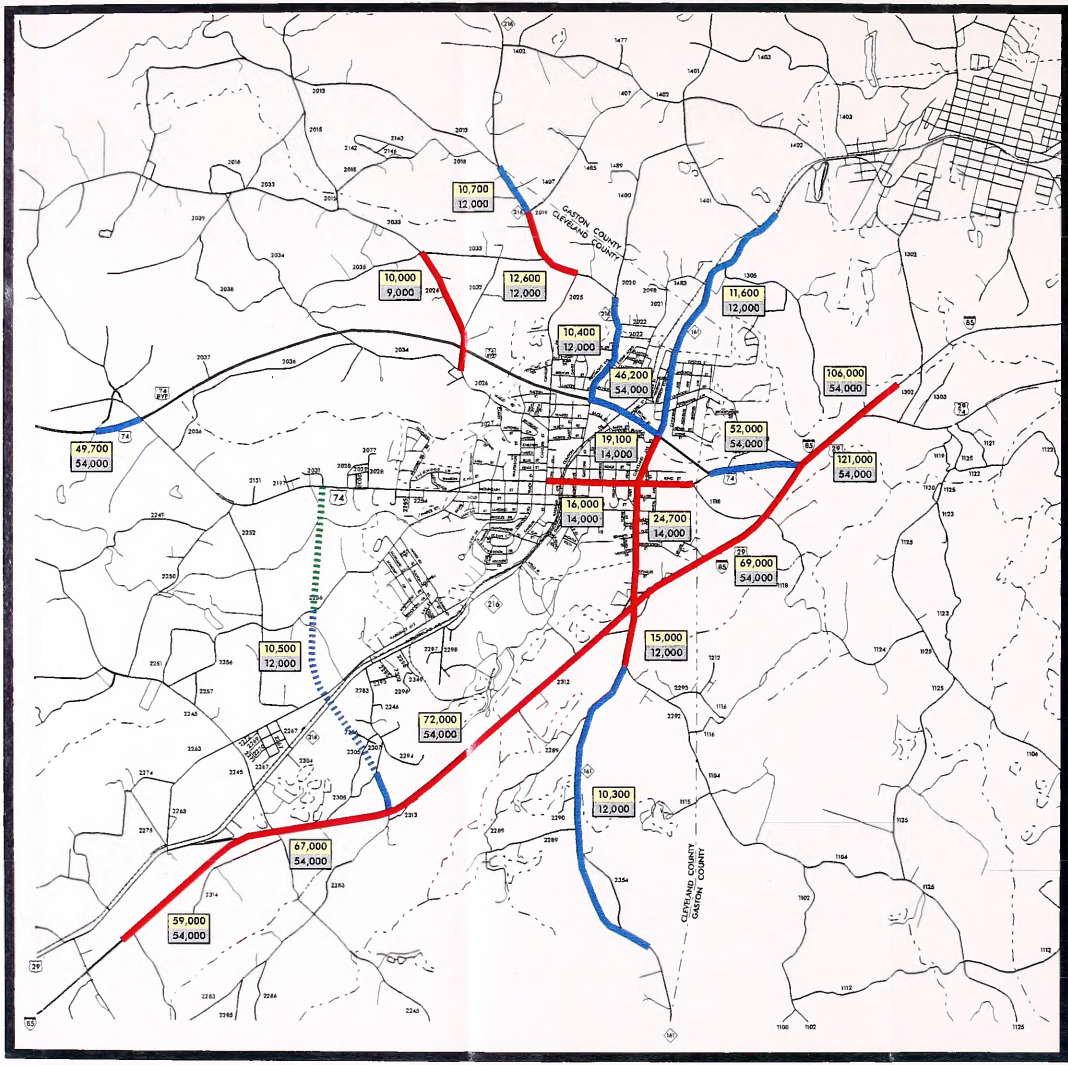

N

LEGEND

2020 TRAFFIC VOLUMES	00,000
EXISTING & COMMITTED CAPACITY	00,000
AT OR OVER CAPACITY (V/C ≥ 1.00)	
NEAR CAPACITY (0.8 ≤ V/C < 1.00)	
TIP R-2625	
TIP (NEAR CAPACITY)	

FIGURE 6

2020 CAPACITY DEFICIENCIES

KINGS MOUNTAIN

June 25, 1996

CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH
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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 2 3 kilometers

0 1 2 miles

V. Existing and Projected Conditions

The flow of traffic within a network is based on the land use, population, economic conditions, and conditions of the travelways within the network (refer to **Chapter IV**). Before an accurate estimate can be made for future travel patterns, an accurate investigation of present land use, population, economy, and road usage must be completed.

Land Use

Existing Conditions

In Kings Mountain, residential development is located primarily to the west of NC 216 and to the north of US 74 Business. However, there are numerous well developed subdivisions throughout the area.

Much of Kings Mountain's commercial development is concentrated in the downtown area along King Street and Gold Street. There is also scattered commercial development along NC 161.

Industrial development is primarily located east of NC 216 and south of US 74 Business. Other industrial development is scattered throughout the area including an industrial park located off Cleveland Avenue.

Public land use including churches, cemetaries, schools, hospitals, public buildings, and recreationl areas are scattered throughout the planning area. Recreational and cultural facilities include the Kings Mountain National Military Park, a fire museum, and the Little Theater. Kings Mountain also has a country club, golf course, numerous tennis courts, several swimming pools, and several shopping centers.

Future Conditions

There are several basic variables used to forecast future land development. These include: anticipated population changes; historical trends in the different types of development; the availability and effectiveness of legal controls, regulations, and ordinances; the availability of utility and transportation facilities; and major topographic or other environmental features.

The Kings Mountain planning area population is expected to grow at a rate of approximately 0.6% per year. As a result, residential, commercial, and industrial development is expected to grow at a similar rate. **Figure 7** highlights

the projected high housing and employment growth zones in the Kings Mountain area. These estimates were developed in cooperation with the City of Kings Mountain.

Residential, commercial, and industrial growth are all expected to continue in the areas that they currently exist. Commercial growth downtown is expected to continue through the renovation of existing buildings. Refer to **Figure 8** for Kings Mountains Land Development Plan.

Population Trends

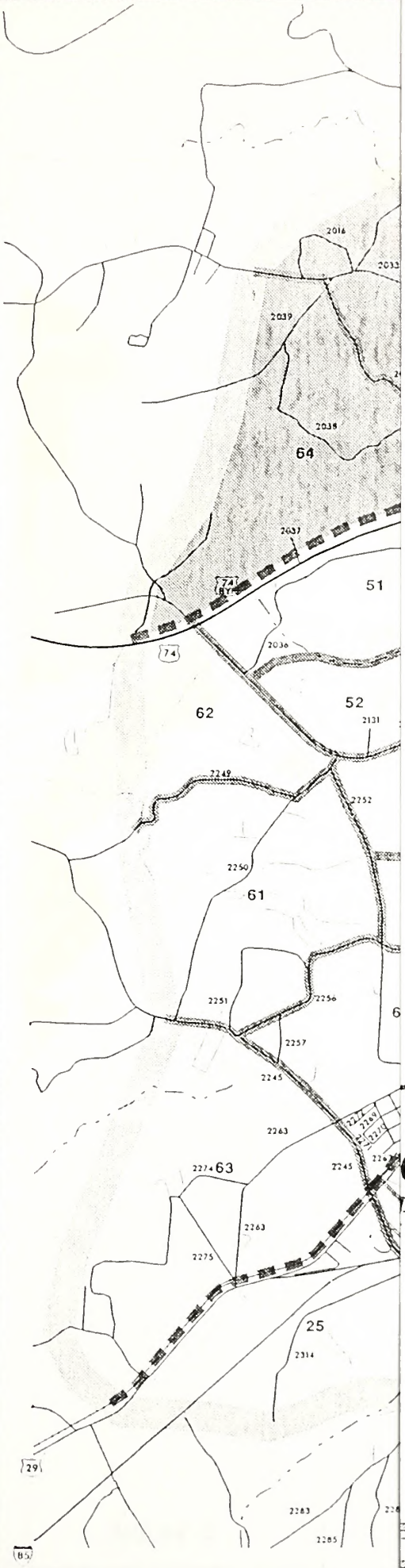
Travel is directly related to the population of an area. The volume of traffic on a particular section of roadway is closely related to the size and the distribution of the population it serves. By studying past population counts, future projections can be estimated.

The planning area population trend is the most important component in the development of the thoroughfare plan. The 1990 planning area population for Kings Mountain was determined by multiplying the number of dwelling units by the number of persons per dwelling unit. A dwelling unit survey was taken yielding 6,388 dwelling units, and according to the N. C. State Data Center, the average number of persons per dwelling unit for Cleveland County was 2.59. From this data the 1990 planning area population was calculated to be 16,554. Area projections are shown in **Table 6 and Figures 9 and 10.**

Table 6. Population Trends and Projections

Year	North Carolina	Cleveland County	Kings Mtn. Township	Kings Mtn.	Planning Area
1960	4,556,155	66,048	14,724	8,008	------
1970	5,082,059	72,556	14,897	8,473	------
1980	5,880,095	83,435	16,368	8,430	------
1990	6,628,637	84,713	17,611	8,782	16,554
2000	**7,372,587**	**86,474**	18,483	9,063	17,522
2010	**8,000,310**	**85,852**	19,564	9,348	18,547
2020	**8,584,630**	**84,183**	20,708	9,642	19,632

0000 Projections from the NC Office of State Planning



LEGEND

ZONE BOUNDARY

SCREEN LINE

PLANNING AREA BOUNDARY

HOUSING GROWTH ≥100 DWELLING UNITS

EMPLOYMENT GROWTH ≥150 EMPLOYEES

FIGURE 7

GH HOUSING AND PLOYMENT GROWTH

KINGS MOUNTAIN

June 25, 1996

CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH

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FEDERAL HIGHWAY ADMINISTRATION

SCALES

1 2 3 kilometers

1 2 miles

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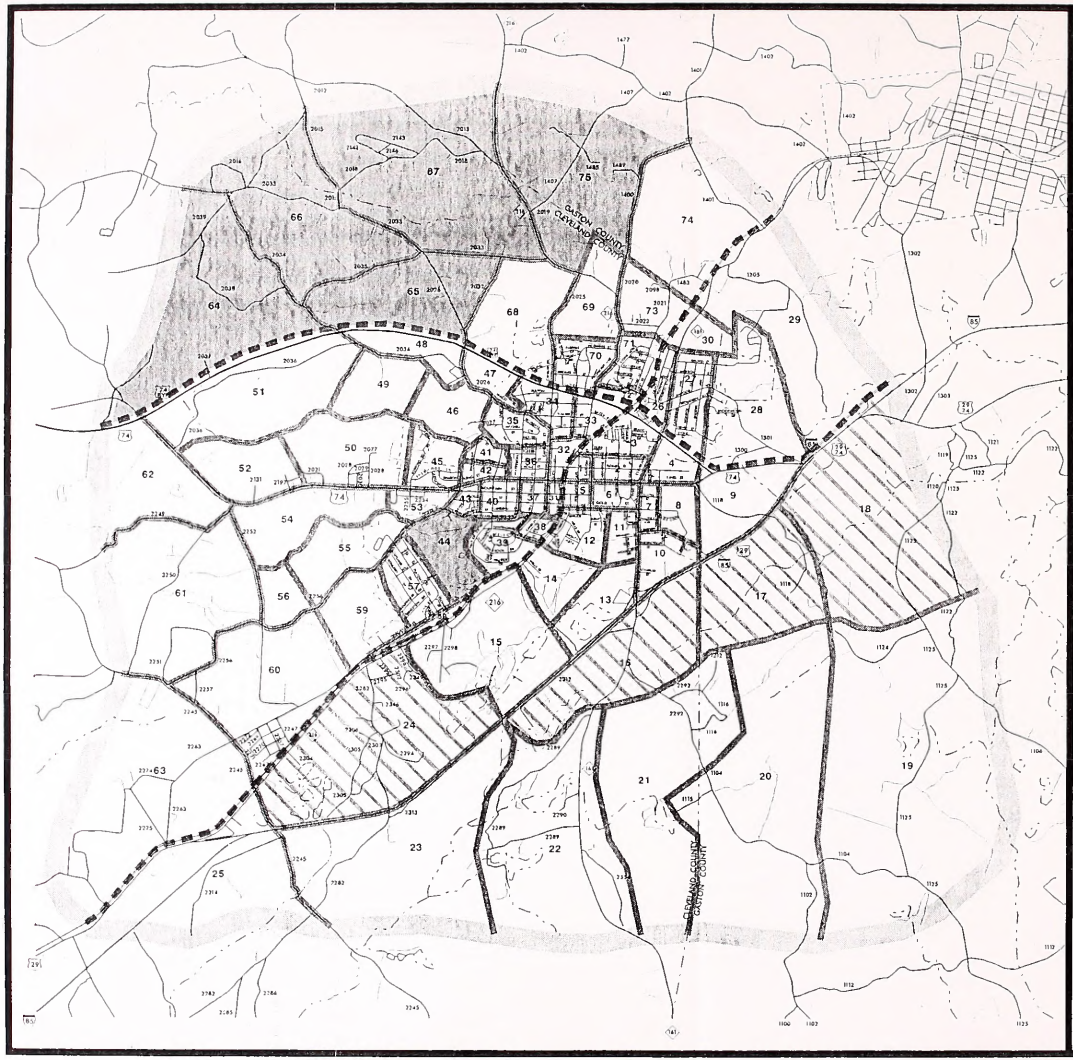
1990	6,628,637	84,713	17,611	8,782	16,554
2000	**7,372,587**	**86,474**	18,483	9,063	17,522
2010	**8,000,310**	**85,852**	19,564	9,348	18,547
2020	**8,584,630**	**84,183**	20,708	9,642	19,632

0000 Projections from the NC Office of State Planning



LEGEND

ZONE BOUNDARY

SCREEN LINE

PLANNING AREA BOUNDARY

HOUSING GROWTH ≥100 DWELLING UNITS

EMPLOYMENT GROWTH ≥150 EMPLOYEES

FIGURE 7

HIGH HOUSING AND EMPLOYMENT GROWTH

KINGS MOUNTAIN

June 25, 1996

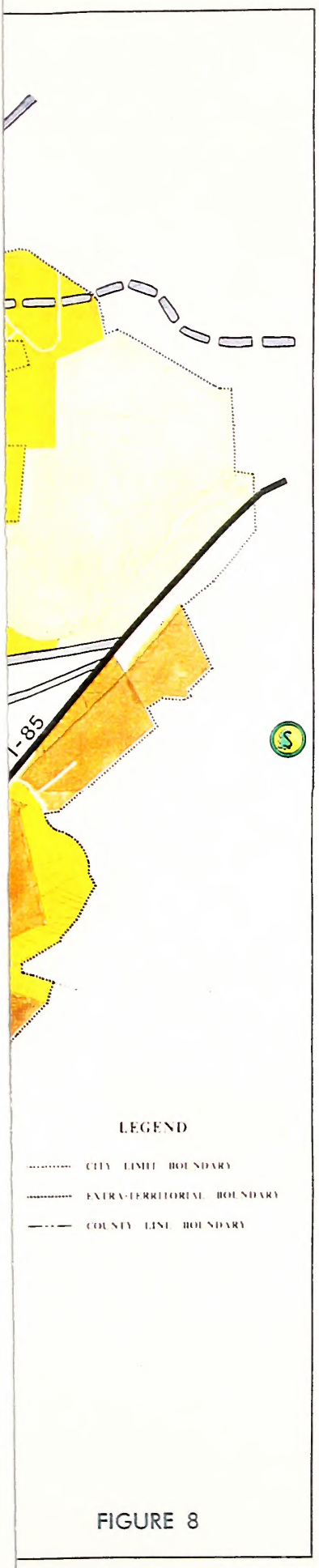
CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 2 3 kilometers

0 1 2 miles



PROPOSED LAND USE

- Residential/Agricultural
- Residential
- Office
- Retail
- Institutional
- Recreation/Open Space
- Public Utilites
- Industrial

- N Kings Mountain National Military Park
- S State Park
- D Proposed District Park
- P Proposed Neighborhood Park

- R Regional Mixed Use Center
- C Community Mixed Use Center
- N Neighborhood Mixed Use Center

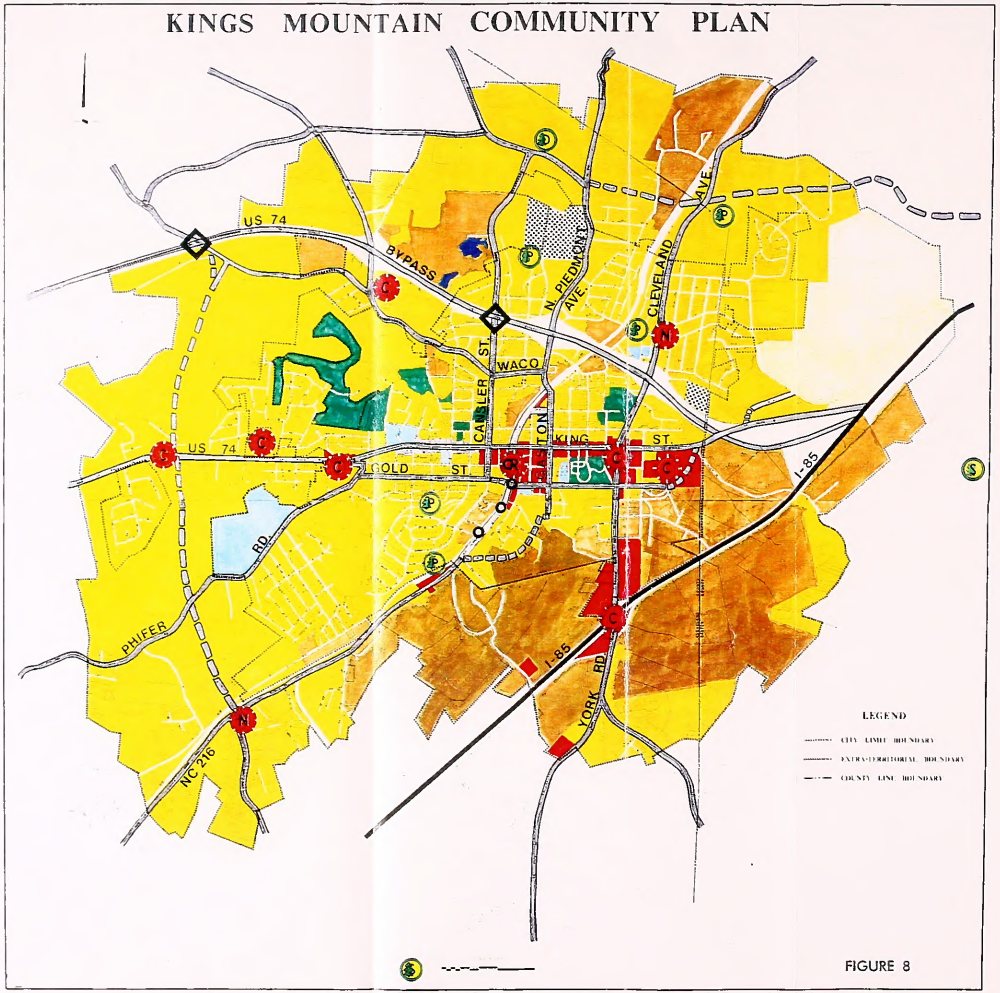
THOROUGHFARE CLASSIFICATIONS

- Interstate
- Major - Existing
- Major - Proposed
- Minor - Existing
- Minor - Proposed

- Interchange - Proposed
- Grade Crossings

FIGURE 8

KINGS MOUNTAIN COMMUNITY PLAN



PROPOSED LAND USE

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- Residential
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- Retail
- Institutional
- Recreation/Open Space
- Public Utilities
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- Kings Mountain National Military Park
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- Neighborhood Mixed Use Center

THOROUGHFARE CLASSIFICATIONS

- Interstate
- Major - Existing
- Major - Proposed
- Minor - Existing
- Minor - Proposed

- Interchange - Proposed
- Grade Crossings

FIGURE 8

Cleveland County
Persons per Dwelling Unit Trends

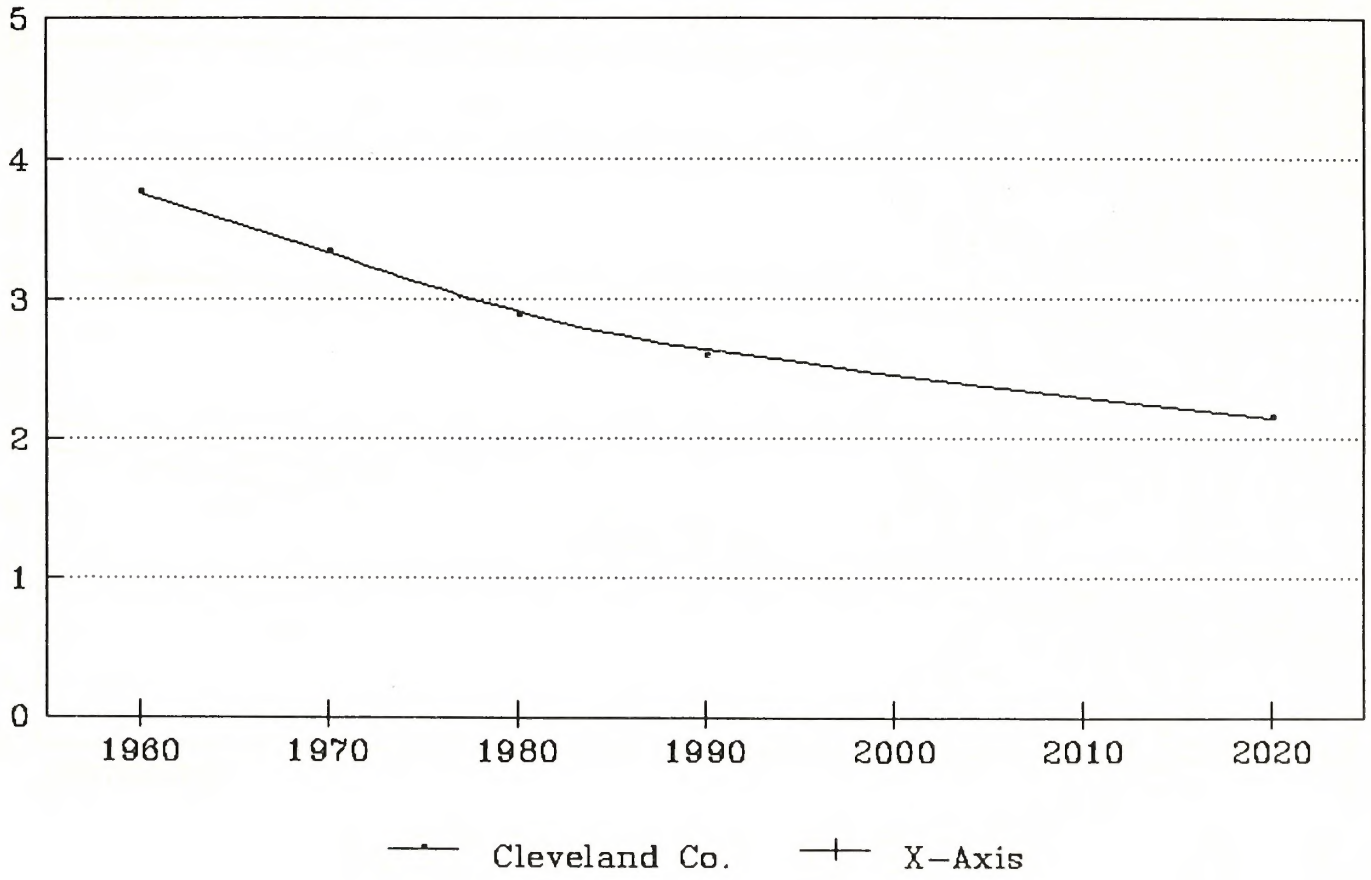


Figure 9

Kings Mountain Planning Area
Population Trends

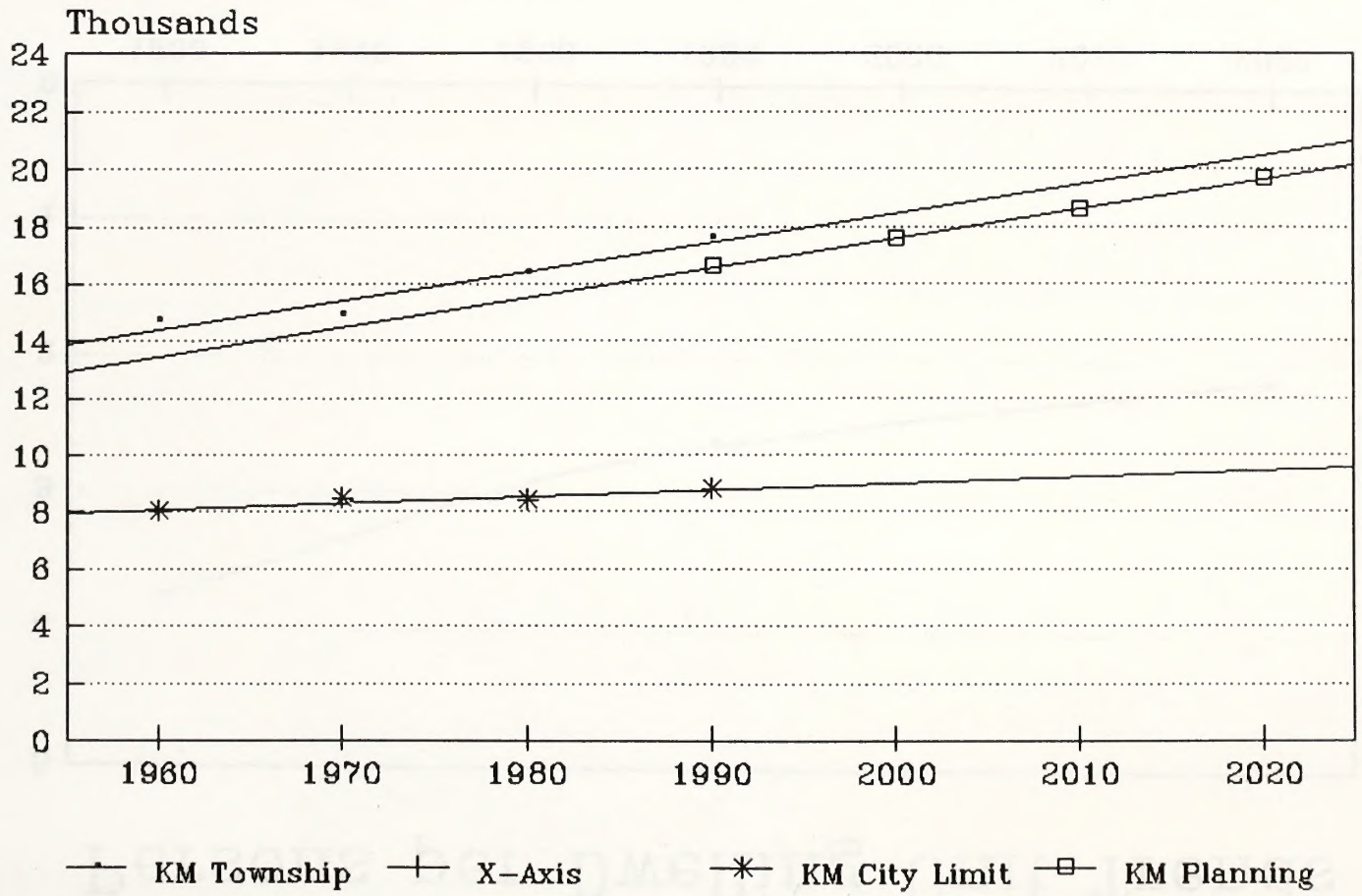


Figure 10

Economy and Employment

The economic base of an area is an important factor to consider in estimating future traffic growth in an area. The economic base determines the employment type and size. This in turn influences the population of the area.

Employment figures for Kings Mountain show that in 1990 there were 7,162 employees of which 67% were industrial, 6% were other retail and wholesale, 3% were highway retail, 5% were financial and administrative, and 19% were service. With this information, the employment to population ratio was calculated to be 0.43. This ratio falls within the normal range of 0.40 to 0.60. This ratio was projected to be 0.49 by the year 2020 based on past employment and population trends. Cleveland County employment trends yield a growth rate of 1% per year. This trend is graphed in **Figure 11.** Based on this trend and on local knowledge, the Kings Mountain planning area is expected to employ 10,662 people in 2020.

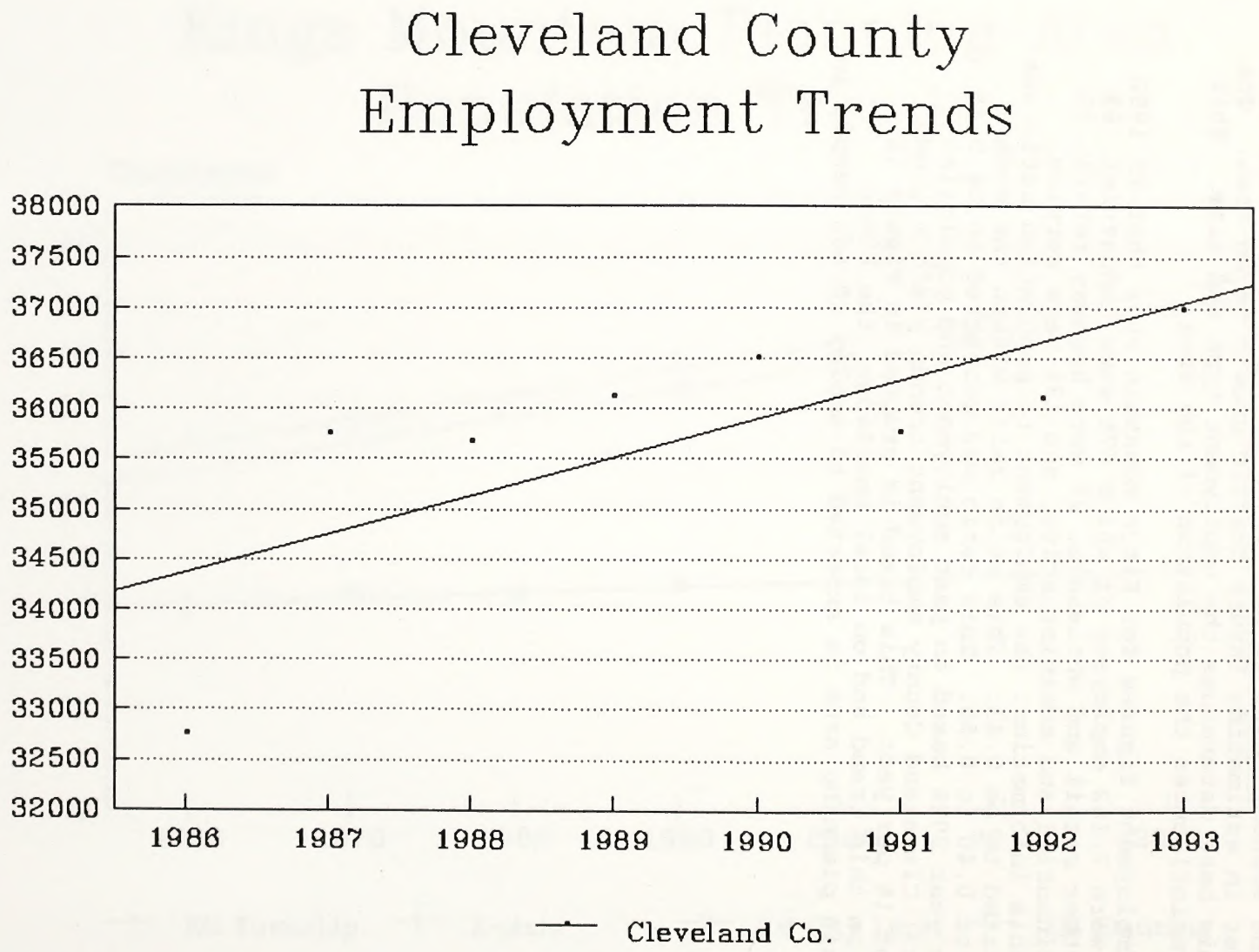

Cleveland County
Employment Trends
38000
37500
37000
36500
36000
35500
35000
34500
34000
33500
33000
32500
32000
1986
1987
1988
1989
1990
1991
1992
1993
Cleveland Co.

Figure 11

VI. Environmental Concerns

In the past several years, environmental concerns associated with highway construction have come to the forefront of the planning process. Section 102 of the National Environmental Policy Act requires the execution of an environmental impact statement (EIS) for highway projects that have a significant impact on the environment. Included in an EIS is a project's impact on wetlands, water quality, historic properties, wildlife, and public lands. Although this report does not include as much detail as an EIS would, preliminary research was done on several of these factors and is reported below.

Wetlands

Wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in and on the surface of the soil. They are crucial ecosystems in our environment. Wetlands help regulate and maintain the hydrology of our rivers, lakes, and streams by slowly storing and releasing flood waters. They help maintain the quality of our water by storing nutrients, reducing sediment loads, and reducing erosion. Wetlands are also critical to fish and wildlife populations. They provide an important habitat for about one third of the plant and animal species that are federally listed as threatened or endangered.[1]

Section 404 of the Clean Water Act of 1977 requires no disruption of wetlands if there is a practical and feasible alternative that would have a less adverse impact on the area. In addition, compensatory mitigation is required if wetlands are impacted.

Wetland impacts have been avoided or minimized to the greatest extent possible while preserving the integrity of the transportation plan.

Threatened and Endangered Species

A preliminary review of the Federally Listed Threatened and Endangered Species within the Kings Mountain planning area was done to determine the effects that new corridors could have on the wildlife. These species were identified using mapping from the North Carolina Department of Environment, Health, and Natural Resources.

[1]Dahl, T. E., and C. E. Johnson. Status and Trends of Wetlands in the Conterminous United States. United States Department of Interior, Fish and Wildlife Service, Washington, DC 1991.

The Threatened and Endangered Species Act of 1973 allows the U. S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stages, we are able to avoid or minimize these impacts.

No proposed improvements are planned for the area that threatened and endangered species were identified in.

Historic Sites

The locations of historic sites in the Kings Mountain planning area were investigated to determine the possible impacts of the proposed improvements.

The federal government requires all State Departments of Transportation to make special efforts to preserve historic sites. Section 106 of the National Historic Preservation Act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The DOT must consider the impact of its road projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

In addition to the federal guidelines, the State of North Carolina has issued its own guidelines for the preservation of historic sites. The NC General Statute 121-12(a) requires the DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. DOT must consider the impacts and consult with the North Carolina Historical Commission, but it is not bound by their recommendations.

There are currently over 550 properties of historic or architectural significance in Kings Mountain's planning area. The majority of these are located in the downtown area. None of these properties will be affected by any of the proposed projects presented in this document.

Archaeological Sites

Archaeological sites are similar in significance to historical sites. However, archaeological sites can be excavated, the findings evaluated, necessary information and data extracted, and then the sites can be used for transportation purposes.

Five archaeological sites have been discovered in Kings Mountain's planning area. These sites were identified using mapping from the archaeology section of the State Historic Preservation Office. However, very little of the planning area has ever been surveyed for archaelogical sites and it is expected

that numerous additional archaelogical resources are located in this area.

VII. Traffic Model Development

In order to develop a Thoroughfare Plan for the City of Kings Mountain, a traffic model was developed. This model was based on the traditional four step planning process: trip generation; trip distribution; mode choice; and trip assignment. The study involved two applications of the process.

Before the four step process could be applied, the planning area had to be defined and the base year (1990) network developed. Then socioeconomic and traffic count data collected in 1990 could be applied to the four step process to simulate the area's 1990 traffic patterns. Once the traffic model accurately reproduced the traffic counts, the socioeconomic data and the external station volumes (traffic volumes at the outskirts of the planning area boundary) were projected to the design year (2020) and applied to the same four step process to forecast future traffic patterns. The future traffic patterns were then compared to existing capacities and possible solutions to the anticipated problems were tested.

The Planning Area

The planning area for the City of Kings Mountain includes the current city limits and the outlying areas that are projected to develop by the design year 2020. After the planning area was defined, it was divided into four sections. This was done using two screenlines, one north-south along the railroad tracks, the other east-west along US 74 Bypass. These screenlines were later used in the model calibration process (the process by which various factors are adjusted in order to duplicate existing travel patterns as accurately as possible). The planning area was then further divided into 75 traffic zones for the collection and distribution of socioeconomic data. The planning area, screenlines, and traffic zones are shown in **Figure 12**.

The Base Year Network

The purpose of the traffic model is to duplicate the conditions of the existing street system. Therefore, one of the first decisions made was which streets would be included on the base year network. These streets must be selected very carefully, because there is a fine line between having too many streets to allow for calibration and having too few streets to realistically represent current conditions.

Several criteria were used to select the base year network. First, good engineering judgment based on general knowledge of the study area was used. Second, traffic counts were used to determine which streets carry a substantial amount of traffic. Finally, the previous thoroughfare plan was used to determine the

existing major and minor thoroughfares. Although several local roads were included in the base year network, the majority of the local roads were represented by connections between traffic zone centroids and modeled streets. The resulting Kings Mountain base year network is shown in **Figure 13**.

Speed and distance were input factors used in coding the base year network. These are important factors, because they define the minimum time paths from one zone to another. The minimum time paths are later used as a basis for assigning traffic to the network. Generally, speeds were input at or slightly below the posted speed limit. This was done to represent as closely as possible the actual speed of traffic traveling on the facility.

Data Requirements

Two types of data were needed to develop the traffic model. First, traffic counts on each street in the network were needed to provide a basis for calibration. Next, socioeconomic data collected for each traffic zone was used to generate traffic on the model.

Traffic Counts

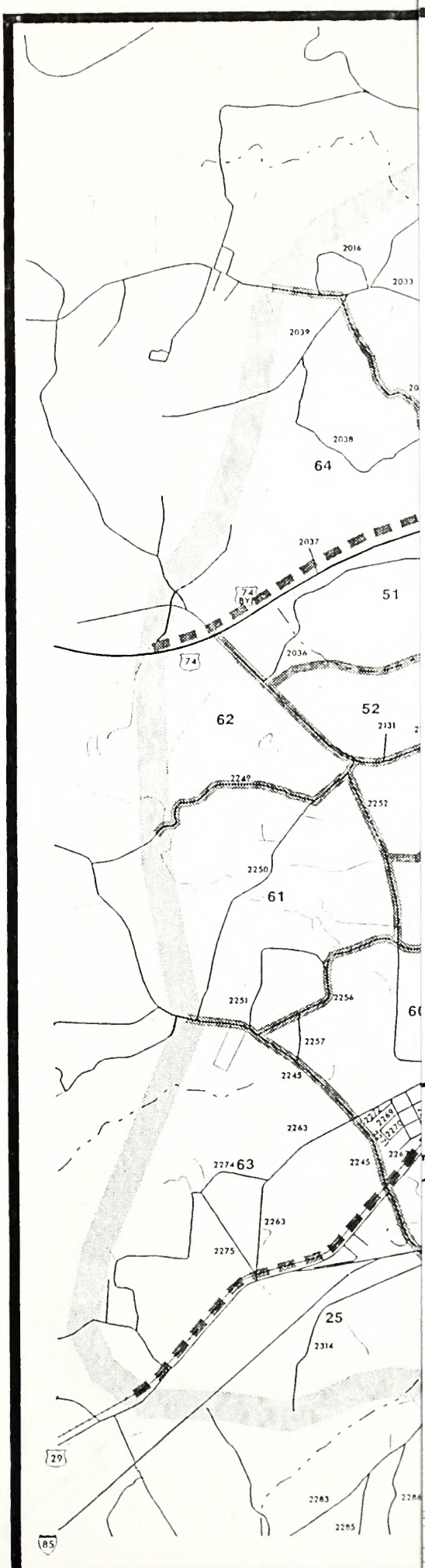
Traffic counts for the Kings Mountain study were collected in July, 1990. Traffic volumes generated during the modeling process were compared to these counts and to Annual Average Daily Traffic counts (AADT's) during the calibration process. The counts taken at the outskirts of the planning area boundary represent the amount of traffic entering and exiting the planning area on an average day in 1990.

Socioeconomic Data

The socioeconomic data consists of a housing inventory and an employment survey both conducted by the Isothermal Planning and Development Commission. First, the housing and employment data for each zone was divided into specific classifications as shown in **Appendix C**. Then, the housing data was used to generate trips on the network, and the employment data was used to attract those trips.

A windshield survey was conducted to collect housing data for each traffic zone. This data was collected based on five categories: excellent; above average; average; below average; and poor. The type and quality of housing was then used to determine the average number of trips made from a household each day.

Employment data was collected using several methods. First, the name and location of the employers were collected using the windshield survey method. Then, each employer was contacted to



LEGEND

ZONE BOUNDARY

SCREEN LINE

PLANNING AREA BOUNDARY

FIGURE 12

TRAFFIC ZONE MAP

KINGS MOUNTAIN

June 25, 1996

CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

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FEDERAL HIGHWAY ADMINISTRATION

SCALES

1 2 3 kilometers

1 2 miles

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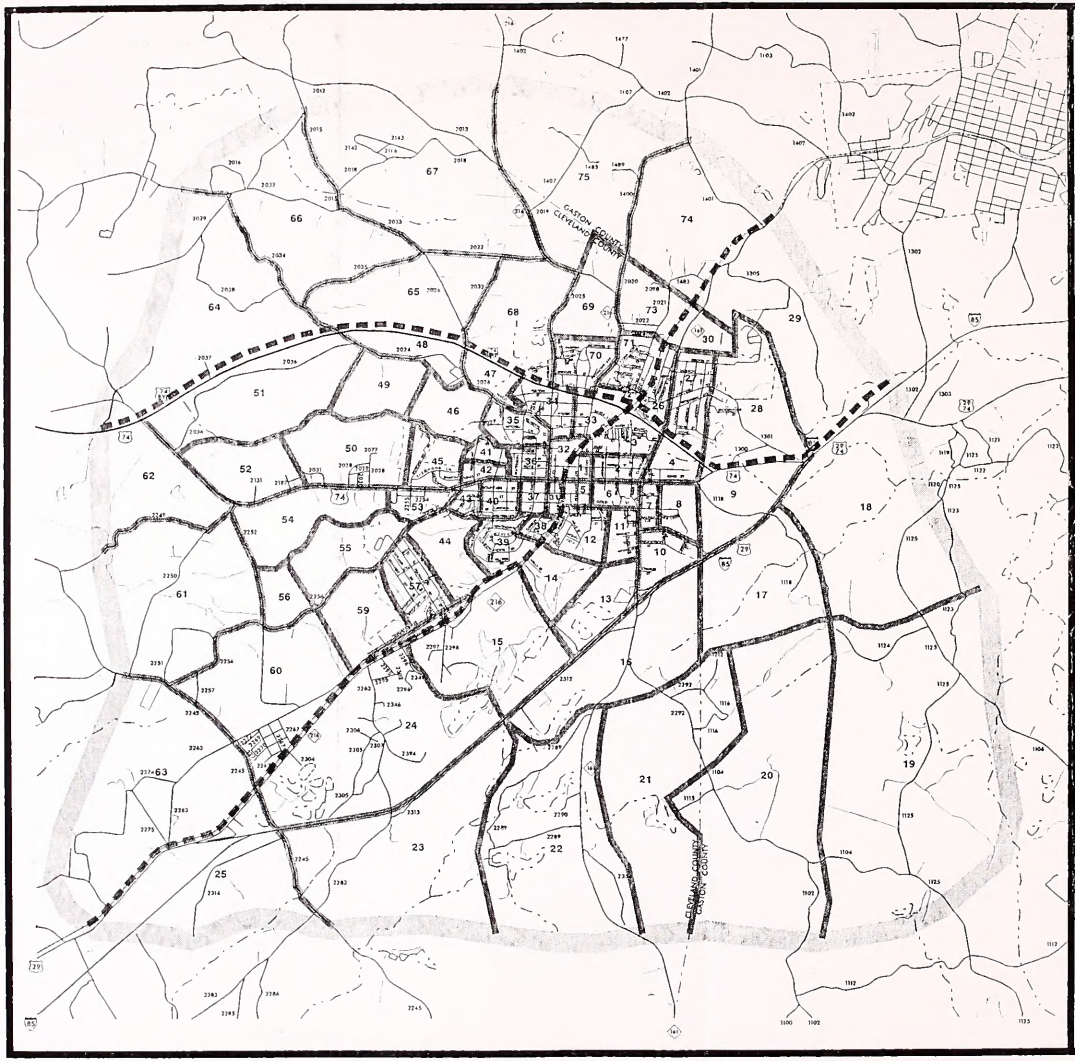

LEGEND

ZONE BOUNDARY

SCREEN LINE

PLANNING AREA BOUNDARY

FIGURE 12

TRAFFIC ZONE MAP

KINGS MOUNTAIN

June 25, 1996

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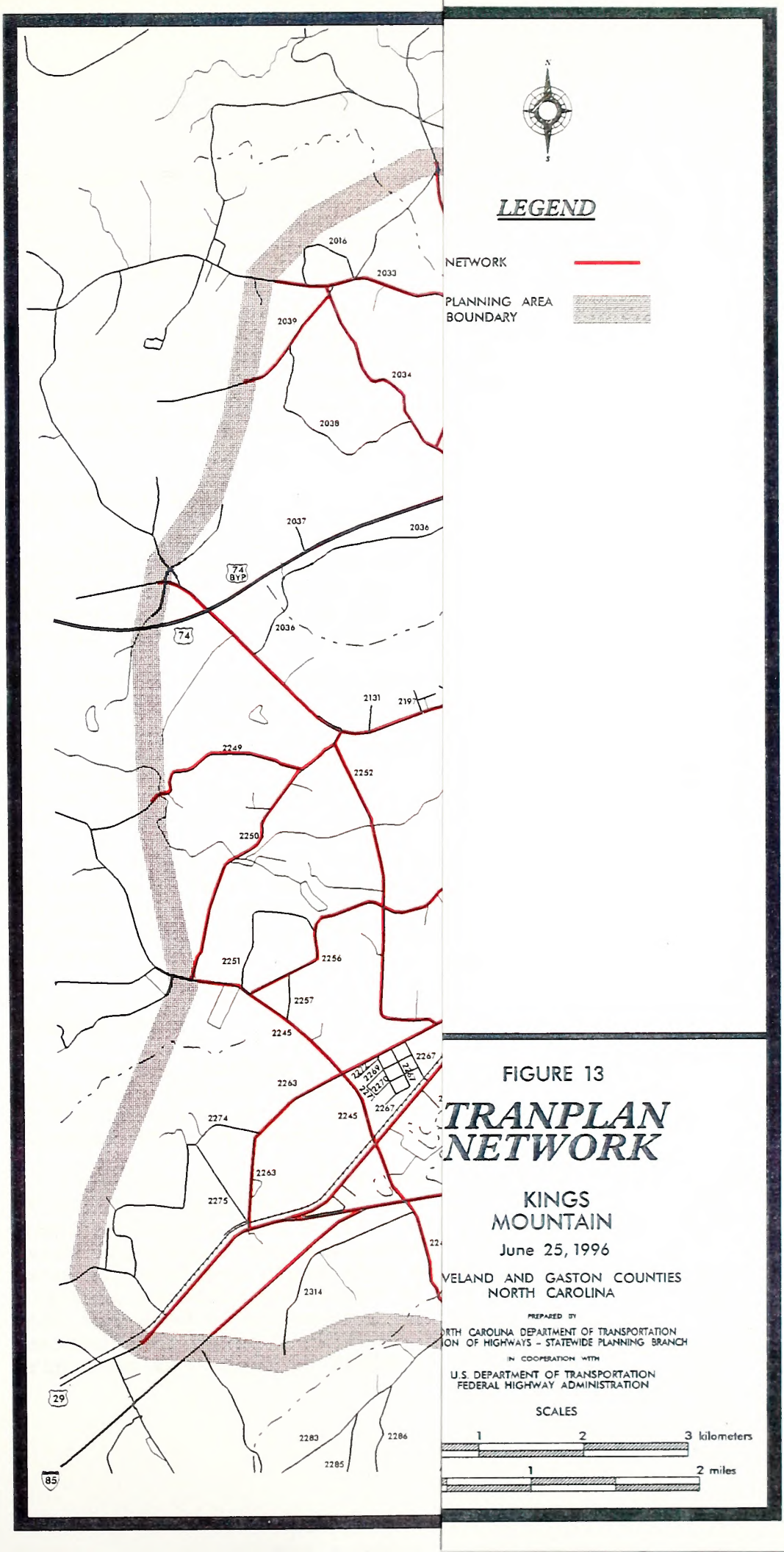
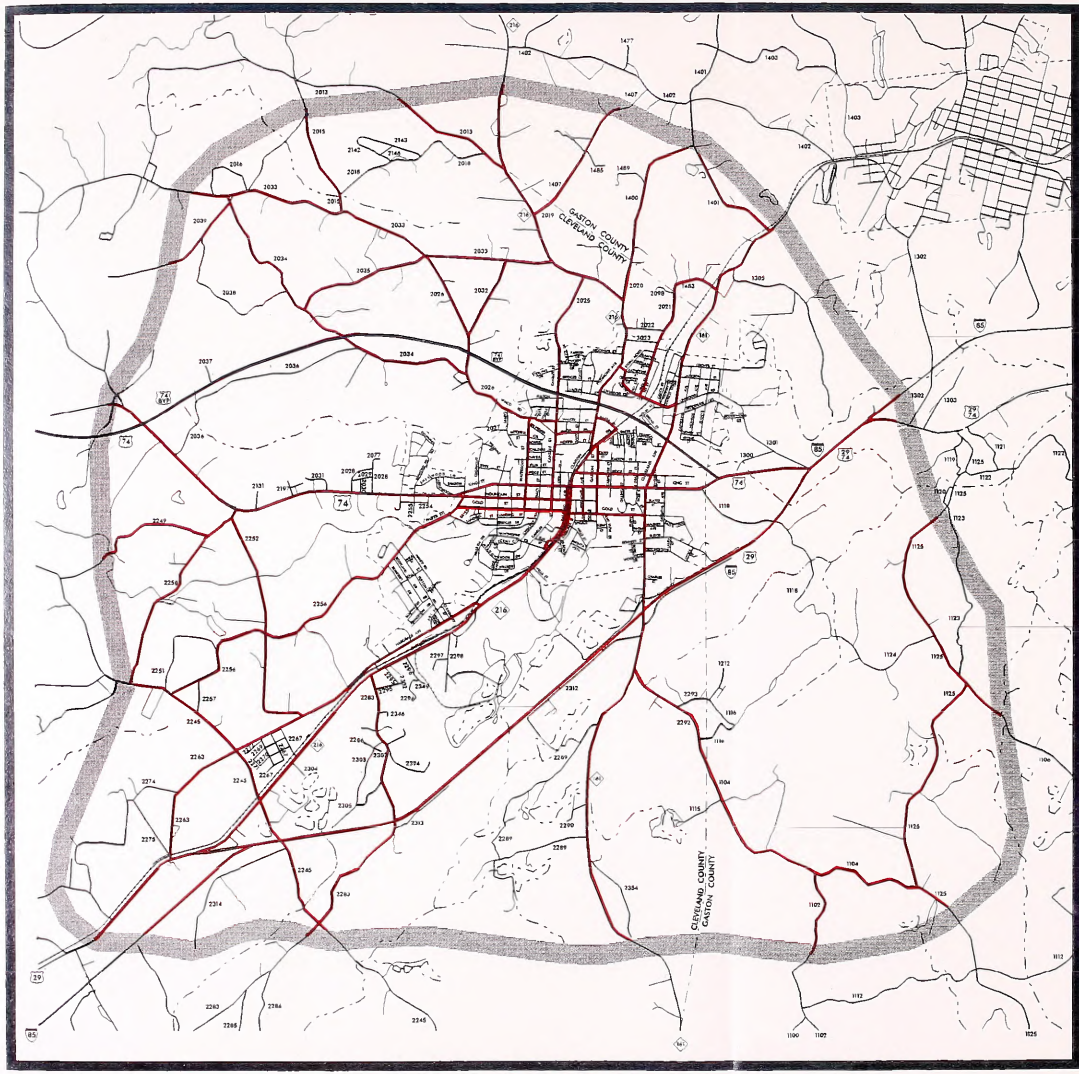
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 2 3 kilometers

0 1 2 miles


LEGEND
NETWORK
PLANNING AREA BOUNDARY
2016
2033
2039
2034
2038
2037
2036
74 BYP
74
2036
2131
2249
2252
2250
2251
2256
2257
2245
2267
2263
2245
2274
2263
2275
2314
29
85
2283
2286
2285
FIGURE 13
TRANPLAN NETWORK
KINGS MOUNTAIN
June 25, 1996
VELAND AND GASTON COUNTIES
NORTH CAROLINA
PREPARED BY
RTH CAROLINA DEPARTMENT OF TRANSPORTATION
ON OF HIGHWAYS - STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
SCALES
1
2
3 kilometers
1
2 miles



LEGEND

NETWORK

PLANNING AREA BOUNDARY

FIGURE 13

TRANPLAN NETWORK

KINGS MOUNTAIN

June 25, 1996

CLEVELAND AND GASTON COUNTIES
NORTH CAROLINA

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DIVISION OF HIGHWAYS - STATEWIDE PLANNING BRANCH
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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 1 2 3 kilometers

0 1 2 miles

determine the number of employees and commercial vehicles at that location. The employment data was then grouped into six categories based on Standard Industrial Codes (SIC): industrial; other retail/wholesale; highway retail; financial/administrative; service; and hospital. This data can also be found in **Appendix D**.

Commercial vehicle data was collected along with the employment data. However, this data was analyzed in the model as a trip generator, like the housing, rather than a trip attractor, like the employment. Commercial vehicles generate trips differently from privately owned vehicles. They produce trips based on the type vehicle rather than the type of location.

Trip Generation

Trip generation is the first step in the traditional four step modeling process. It is defined as the relationship between trip making and household characteristics. This process takes the external station volumes and the socioeconomic data and generates traffic volumes to simulate the street system's actual volumes.

During the trip generation process, one trip is generated for each origin and destination. In other words, if a person leaves home, stops at the gas station, and then continues on to work, he/she has made two trips in terms of the trip generation process. The origin for the first trip is home, and the destination is the gas station. The origin for the second trip is the gas station, and the destination is work.

The trips created during the trip generation process are divided into three categories: external-external trips (commonly referred to as "through trips"), external<->internal trips, and internal trips (calculated through the Internal Data Summary process).

Through Trips

Through trips are trips produced outside of the planning area which pass through the planning area to a destination also outside of the planning area. They are one of two components of the external station counts.

The through trips for this study were developed using a set of models created by David Modlin, P.E., Ph.D. and computerized by James McDonnell, P.E. This method is based on the fratar balancing method which balances the trip interchanges at the external station. Once this method was completed, engineering judgment based on knowledge of the area and the function of the road was used to ultimately determine the number of trip-ends passing through each external station. The resulting through trip-ends are shown in **Table 7**.

Table 7. Cordon Station Travel

Cordon Station and Description	1990 ADT	1990 Through Trip Ends	1990 Ext-Int Trips	2020 ADT	2020 Through Trip Ends	2020 Ext-Int Trips	Percent Through Trips
101 I-85	24,000	22,856	1,144	59,102	56,658	2,444	95.20
102 US 29	4,960	1,528	3,432	14,230	4,414	9,816	30.80
103 SR 2276	300	16	284	733	39	694	5.30
104 SR 2245	3,260	426	2,834	7,921	1,048	6,873	13.10
105 SR 2249	380	18	362	930	43	887	4.70
106 US 74	20,440	12,260	8,180	49,676	30,189	19,487	60.00
107 SR 1001	3,040	422	2,618	7,391	1,038	6,353	13.90
108 SR 2039	280	16	264	678	38	640	5.70
109 SR 2033	3,320	444	2,876	8,079	1,091	6,988	13.40
110 SR 2015	360	18	342	877	43	834	5.00
111 SR 2013	780	50	730	1,889	122	1,767	6.40
112 NC 216	3,500	686	2,814	8,533	2,252	6,281	19.60
113 SR 1407	700	44	656	1,695	107	1,588	6.30
114 SR 1401	570	30	540	1,858	73	1,785	5.30
115 NC 161	5,200	1,254	3,946	11,558	2,818	8,740	24.10
116 I-85	38,500	34,204	4,296	105,833	93,386	12,447	88.80
117 US 29-74	12,320	6,192	6,128	29,944	15,089	14,855	50.30
118 SR 1125	3,400	2,472	928	8,262	6,008	2,254	72.70
119 SR 1106	2,030	2,018	12	4,949	4,892	57	99.40
120 SR 1125	730	242	488	1,894	587	1,307	33.20
121 SR 1102	130	2	128	318	5	313	1.54
122 NC 161	4,220	716	3,504	10,258	1,749	8,509	17.00
123 SR 2245	820	52	768	1,983	127	1,856	6.30
124 SR 2283	1,280	98	1,182	3,109	236	2,873	7.70

External<->Internal Trips

External<->Internal (Ext<->Int) trips have one trip-end inside the planning area and one trip-end outside the planning area. These trips are the second component of the external station count. The external<->internal trips are calculated by subtracting the number of through trip-ends at an external station from the total traffic volume at that station. The results of this cordon station analysis are shown in **Table 7, page 56**.

Internal Trips

Internal trips have both their origin and destination inside the planning area. They are separated into three trip purposes: home based work (HBW), other home based (OHB), and non-home based (NHB). These trips were calculated using Internal Data Summary (IDS), a computer program written by Michael Bruff, P.E., of the Statewide Planning Branch. This program calculates trip productions and trip attractions for use in the gravity model (further explained in the next section).

Trip productions were produced using the IDS program. Generation rates were applied to the housing data and the commercial vehicle data. Each housing group (discussed previously) was assigned a coefficient representative of the number of trips made per household in that group. The average trip generation rate for the Kings Mountain planning area is 6.57 trips per dwelling unit. This rate is slightly lower than the State's average of 7 to 8 due to the large number of trips made outside the Kings Mountain planning area. Generation rates used in the Kings Mountain study can be found in **Table 11, page 63.**

Trip attractions were also produced using the IDS program. Employment data was applied to a set of regression equations to create trip attractions for each trip purpose. The equations used in the Kings Mountain study were based on equations taken from a similar study and are as follows:

$$\text{HBW} \quad Y = 1.00X_1 + 1.00X_2 + 1.00X_3 + 1.00X_4 + 1.00X_5 + 1.00X_6$$
$$\text{OHB} \quad Y = 0.10X_1 + 2.00X_2 + 7.50X_3 + 1.90X_4 + 2.50X_5 + 1.00X_6$$
$$\text{NHB} \quad Y = 0.20X_1 + 2.00X_2 + 7.50X_3 + 1.90X_4 + 2.50X_5 + 1.00X_6$$
$$\text{E<->I} \quad Y = 0.30X_1 + 2.00X_2 + 7.50X_3 + 1.90X_4 + 2.50X_5 + 1.00X_6$$

Where: Y = Attraction factor for each zone
X_1 = Industrial (SIC codes 1-49)
X_2 = Other retail (SIC codes 50-54, 56, 57, 59)
X_3 = Highway retail (SIC codes 55, 58)
X_4 = Financial and administrative (SIC codes 60-67, 91-97)
X_5 = Service (SIC codes 70-76, 78-89, 99)
X_6 = Special regression coefficient for the hospital

The remaining component of internal trips is made up of non-home based secondary trips (NHBS). Non-home based secondary trips

are internally generated trips made by vehicles garaged outside the planning area. An example of this type of trip would be a trip to the grocery store on the way home from work where the grocery store and work are inside of the planning area, and home is outside of the planning area. It was assumed that 45% of these externally garaged trips made a secondary trip while in the planning area. These trips were determined using the following equation:

$$\text{NHB Secondary Trips} = \left[\text{Total Ext<->Int Trips} - \text{Ext<->Int Trips Garaged Inside Planning Area}\right] \times 0.45$$

1990 Secondary Trips = (48,456-6,948) x 0.45 = 18,679

Running IDS required assigned percentages to be input for each trip type and trip purpose. Internal trips that remained inside of the planning area boundary consisted of 85% of the total internally generated trips. This resulted in 15% internal-> external trips. (Trips which are generated internally but travel outside of the planning area.) Of the 85% internally generated trips: 24.3% were home based work; 53.1% were home based other; and 22.6% were non-home based.

Trip Distribution

Trip distribution is the second step in the traditional four step process. After the number of trips per traffic zone was determined, the trips were distributed to other traffic zones in the network using the Gravity Model. The Gravity Model is based on the concept that the transportation demand between two zones is proportional to the size of the productions and attractions in all zones and is inversely related to the impedance (such as time or distance) between zones. The gravity model uses the following equation:

$$T_{ij} = P_i \times \frac{A_j \times F_{ij} \times K_{ij}}{\text{Sum } j=1,\ n\ (A_j \times F_{ij} \times K_{ij})}$$

Where:
- i = Origination zone
- j = Destination zone
- n = Total number of zones
- T = Number of trips produced in zone i and attracted to zone j
- P = Number of trips produced in zone i
- A = Number of trips attracted by zone j
- F = Friction factor from zone i to zone j
- K = Socioeconomic adjustment factor

The friction factor (F) is critical to the gravity model distribution. It represents the effect that various impedances, such as travel time and trip purpose (HBW, OHB, NHB, and EXT<->INT), can have on the overall travel time between zones. The friction factors for the Kings Mountain study were calculated in the Calibrate Gravity Model process using trip length distribution factors adjusted from the 1966 Kinston origin - destination study. **Table 8** shows the values used for the trip length frequency curves and the friction factors.

Table 8. Trip Length Frequency Curve and Friction Factor Data

Travel Time (Min.)	Trip Length Frequency Curves (% Trips Distributed)				Friction Factors (Trips Distributed)			
	HBW	HBO	NHB	E<->I	HBW	HBO	NHB	E<->I
1	0.00	0.00	0.00	0.00	1605080	3901351	520747	1670409
2	20.77	28.74	30.00	2.75	1423579	1731350	593333	690130
3	23.89	24.42	34.50	5.00	886980	730681	421803	338687
4	21.34	18.22	20.20	10.85	412761	295009	210217	191123
5	16.05	12.59	9.70	15.10	152525	114630	82524	120049
6	10.39	7.82	3.80	24.75	47582	43123	28671	81250
7	5.48	4.29	1.30	16.75	13324	15800	9906	57357
8	1.80	2.30	0.50	12.05	3560	5672	3824	40883
9	0.28	1.24	0.00	7.25	965	2007	1853	28483
10	0.00	0.38	0.00	3.55	282	704	1267	18775
11	0.00	0.00	0.00	1.30	95	246	1372	11335
12	0.00	0.00	0.00	0.65	39	87	2647	6067

Mode Choice

Mode choice is the third step in the traditional four step process. This step predicts the amount of travel that will be made by each available type of transportation. Typically, the two mode types analyzed are auto and transit. However, because Kings Mountain does not operate a transit system, auto was the only mode of travel analyzed in this study.

Trip Assignment

Trip assignment is the final step in the four step process. This step determines what route a trip will take to reach its destination.

Trips can be assigned using several different methods, including all-or-nothing, capacity restraint, or equilibrium. The all-or-nothing method is the simplest form of loading and works best in uncongested areas. This method assigns the trips based

only on minimum time paths (the route with the shortest travel time). The capacity restraint method simulates the effect that congestion has on each route. This method allows trips to be loaded incrementally while changing the impedance on a route as the traffic increases. The equilibrium method applies the theory of capacity restraint until no trip can improve its impedance by changing routes.

The capacity restraint method was selected for the Kings Mountain model. The trips were loaded in three increments: 70%; 20%; and 10%. This allowed new impedences to be computed after each iterative loading. Therefore, as the volume to capacity ratio increased on a route, the travel time on that route changed incrementally due to the congestion.

Model Calibration

The purpose of the traffic model is to predict traffic in the area at some future point in time. To do this, trips must be assigned so that the generated traffic matches the actual traffic. This is done through calibration -- an iterative process during which incremental changes can be made to the network, trip generation, or trip distribution. The purpose for each change is to more accurately reflect the travel patterns occurring on the existing street network. Once the model accurately reflects the existing traffic, it can be used to predict traffic in the future.

Level of Accuracy

Three steps were taken to check the level of accuracy of the Kings Mountain model. The first step was to follow the trips through each step involved in developing the traffic model. The purpose of this was to ensure that no trips had been accidently added or subtracted, and that no trips had been counted twice. The second step was to compare the trips generated by the model with the traffic counts taken at the screenlines. The model is considered to accurately reflect the overall traffic patterns of the actual street system if the number of trips generated is between 95% and 105% of the ground counts. **Table 9** shows the comparison of ground counts with the generated traffic volumes for the Kings Mountain study.

Table 9. Actual vs. Generated Screenline Totals

Screenline	Ground Count	Generated Volume	Percent
A (NS)	48858	50774	96
B (EW)	27488	26688	103

The final check on the model was to match the generated volumes on individual links to the ground counts on the same links. This process is used to locate specific problems that might be present in the network.

Design Year Projections

Once the model was calibrated, design year projections for internal trips (housing, employment, and commercial vehicles), through trips, and external<->internal trips were determined. These data projections were then input into the same four step process used to create the base year model.

Internal Trip Projections

Housing and employment projections were used to develop the internal trips for the design year 2020. These projections were developed through a collaborative effort between NCDOT's Statewide Planning Branch and Kings Mountain's Thoroughfare Planning Committee.

Total housing was projected by the Statewide Planning Branch based on past persons per dwelling unit trends and past population trends. Then, the Statewide Planning Branch and the Kings Mountain Thoroughfare Planning Committee worked together to distribute these projections to each traffic zone based on the Kings Mountain Land Development Plan. The projections were then divided into the five categories discussed previously. This information can be found in **Appendix D.**

Total employment was also projected by the Statewide Planning Branch. It was based on past employment trends and past population trends. After the total number of employees was projected, the Statewide Planning Branch and the Kings Mountain Thoroughfare Planning Committee worked together to distribute these projections to each traffic zone based on the Kings Mountain Land Development Plan. The projections were then further divided into the six categories discussed previously. This information can also be found in **Appendix D.**

Finally, commercial vehicle data had to be adjusted to reflect the assumed conditions in the design year. The following equations were used to project commercial trucks (trucks) and commercial autos (CA) to the design year. The resulting factor for each was 1.35. The projected commercial vehicle data can be found in **Appendix D.**

$$Trucks_{2020} = (Employ._{2020} - Employ._{1990}) \times R_{TR} + Trucks_{1990}$$

Where:

$$R_{TR} = \frac{Trucks_{1990}}{Employ._{1990}}$$

$$CA_{2020} = (Employ._{2020} - Employ._{1990}) \times R_{CA} + CA_{1990}$$

Where:

$$R_{CA} = \frac{CA_{1990}}{Employ._{1990}}$$

The IDS program was then run using the design year socioeconomic data, commercial vehicle data, trip generation rates, and non-home based secondary trips. **Table 10** shows the travel model input variables used to run IDS. The following formulas were used to develop design year trip generation rates and non-home based secondary trips:

$$\text{Increase for 2020 Generation Rates} = \left[\text{Avg 1990 Trip Rate} \times CF\right] - \text{Avg 1990 Trip Rate}$$

$$\text{Increase for 2020 Generation Rates} = (6.57 \times 1.04) - 6.57 = 0.26$$

Where:

$$\text{Composite Factor (CF)} = \frac{\text{1990 Veh. Ownership}}{\text{2020 Veh. Ownership}} \times \text{Usage Factor} \times \frac{\text{2020 Persons/DU}}{\text{1990 Persons/DU}}$$

$$CF = \frac{1.41}{1.04} \times 0.99 \times \frac{2.15}{2.59} = 1.04$$

$$\text{NHB Secondary Trips} = \left[\text{Total Ext<->Int Trips} - \text{Ext<->Int Trips Garaged Inside Planning Area}\right] \times 0.45$$

$$\text{2020 Secondary Trips} = (119{,}648 - 10{,}958) \times 0.45 = 48{,}911$$

Through and External<->Internal Trip Projections

The base year through and external<->internal trips were projected to the design year 2020 using a linear projection of each external station's past growth rates along with knowledge of the area's development patterns. A summary of travel in the planning area is shown in **Table 11.** **Table 7, page 56** shows the through trip-ends and external<->internal trips determined for this study as well as the traffic count at each external station.

Table 10. Travel Model Input Variables

		1990	2020
Trip Percentages by Purpose ——>	Internal of Total	85.0%	85.0%
	Home Based Work	24.3%	24.3%
	Other Home Based	53.1%	53.1%
	Non-Home Based	12.6%	12.6%
Persons/Dwelling Unit		2.59	2.15
Average Daily Trips/Dwelling Unit		6.57	7.36
Employment to Population Ratio		0.43	0.49
Trip Generation Rates for Housing ——>	Excellent	12.0	12.3
	Above Average	10.0	10.3
	Average	8.0	8.3
	Below Average	6.0	6.3
	Poor	4.0	4.3

Table 11. Travel Data Summary

Type of Travel	1990	2020
Through Trips	43,032	111,026
External<->Internal Trips	48,456	119,648
Internal Trips	35,698	57,114
Home Based Work	8,689	13,902
Home Based Other	18,948	30,316
Non-Home Based	8,061	12,896
Non-Home Based Secondary Trips	18,679	48,911

APPENDICES

Appendix A

Thoroughfare Planning Principles

Objectives

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare planning is the process that public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with the changing traffic patterns. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and it helps eliminate unnecessary improvements, so needless expense can be averted. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial, and industrial development affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1. providing for the orderly development of an adequate major street system as land development occurs;

2. reducing travel and transportation costs;

3. reducing the cost of major street improvements to the public through the coordination of the street system with private action;

4. enabling private interests to plan their actions, improvements, and development with full knowledge of public intent;

5. minimizing disruption and displacement of people and businesses through long range advance planning for major street improvements;

6. reducing environmental impacts, such as air pollution, resulting from transportation; and

7. increasing travel safety.

Thoroughfare planning objectives are achieved through both improving the operational efficiency of thoroughfares and improving the system's efficiency through system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry more vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined by the maximum number of vehicles which can pass a given point on a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include street widening, intersection improvements, improving vertical and horizontal alignment, and eliminating roadside obstacles. For example, widening of a street from two to four lanes more than doubles the capacity of the street by providing additional maneuverability for traffic. This reduces the impedances to traffic flow caused by slow moving or turning vehicles and the adverse effects of horizontal and vertical alignments.

Operational ways to improve street capacity include:

1. Control of access -- A roadway with complete access control can often carry three times the traffic handled by a non-controlled-access street with identical lane width and number.

2. Parking removal -- Parking removal increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.

3. One-way operation -- The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

4. Reversible lanes -- Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

5. Signal phasing and coordination -- Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

6. Intelligent Transportation System (ITS) - This involves applying advanced concepts and technology in the area of communications, navigation, and information systems to provide solutions to traffic congestion and at the same time improve (highway) safety and reduce environmental effects. It covers passengers, freight, and public transit vehicles and fleets. The ITS Program is structured according to six major systems areas. They are:

   a. Advanced Traffic Management Systems - Provides real-time adjustment of traffic control systems and real-time means for transportation operators to effectively monitor traffic conditions and communicate to devices, quickly adjust traffic operations, and promptly respond to incidents.

   b. Advanced Traveler Information Systems - Provides continuous advice regarding traffic conditions, alternate routes, and warnings regarding road safety.

   c. Commercial Vehicle Operations - Improves operations efficiency and productivity of trucks, buses, and other fleets of vehicles and improves the efficiency of necessary regulatory activities.

   d. Advanced Vehicle Control Systems - Vehicle and/or roadway based electromechancial and communication devices that enhance the control of vehicles by facilitating and augmenting driver performance and ultimately relieving the driver of most tasks on designated instrumented roadways.

   e. Advanced Public Transportation Systems - Provides mass transport users and operators (e.g. buses, vanpoolers, high-occupancy vehicle lanes, carpools, taxicabs) with up-to-date information on status, schedules, and availability of public transit systems including automatic vehicle location and monitoring systems to improve fleet management as well as electronic free media.

   f. Advanced Rural Transportation Systems - Applies ITS technologies (including route guidance, two-way communications, automatic vehicle location, automatic emergency signaling, incident detection, and roadway edge detection) to rural needs.

7. High-Occupancy Vehicle Lanes (HOV Lanes) - This involves designating existing or proposed traffic lanes for exclusive use by high-occupancy vehicles like carpools, vanpools, and buses. These can be altered according to demand to increase capacity. For example, HOV lanes can be designated HOV only during peak hours and/or can be

reversible between the morning and afternoon peak hours to reflect the shift in directional flow of traffic.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways.

1. Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the "people-carrying" capability of the street system.

2. Encourage the use of transit and bicycle modes.

3. Encourage industries, businesses, and institutions to stagger work hours or establish variable work hours for employees. This will spread peak travel over a longer time period and thus reduce peak hour demand.

4. Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost to the user. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification

Streets perform two primary functions -- traffic service and land service. When combined, these services are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property lead to intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets that permits travel from origins to destinations with directness, ease, and safety. Different streets in the system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict. Streets are categorized by function as local access streets, minor thoroughfares, or major thoroughfares. This is shown in **Figure 14.**

Local Access Streets provide access to abutting property. They are not intended to carry heavy volumes of traffic and should

be located such that only traffic with origins and destinations on these streets would be served. Local streets may be further classified as either residential, commercial, and/or industrial depending upon the type of land use they serve.

Minor Thoroughfares are more important streets on the city system. They collect traffic from local access streets and carry it to the major thoroughfares. They may in some instances supplement the major thoroughfare system by facilitating minor through-traffic movements. A third function that may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major Thoroughfares are the primary traffic arteries of the city. Their function is to move intra-city and inter-city traffic. The streets which comprise the major thoroughfare system may also serve abutting property; however, their principle function is to carry traffic. They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic. In addition, each driveway is a danger and an impediment to traffic flow. Major thoroughfares may range from two-lane streets carrying minor traffic volumes to major expressways with four or more traffic lanes. Parking normally should not be permitted on major thoroughfares.

Idealized Major Thoroughfare System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desire lines of travel within an urban area is the radial-loop system. It permits movement between various areas of the city within maximum directness. This system consists of several functional elements--radial streets, crosstown streets, loop system streets, and bypasses. These functional elements are shown in **Figure 14.**

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

Cross-town streets are designed to prevent congestion in the central business district. If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is important to have a system of crosstown streets which form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a

good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

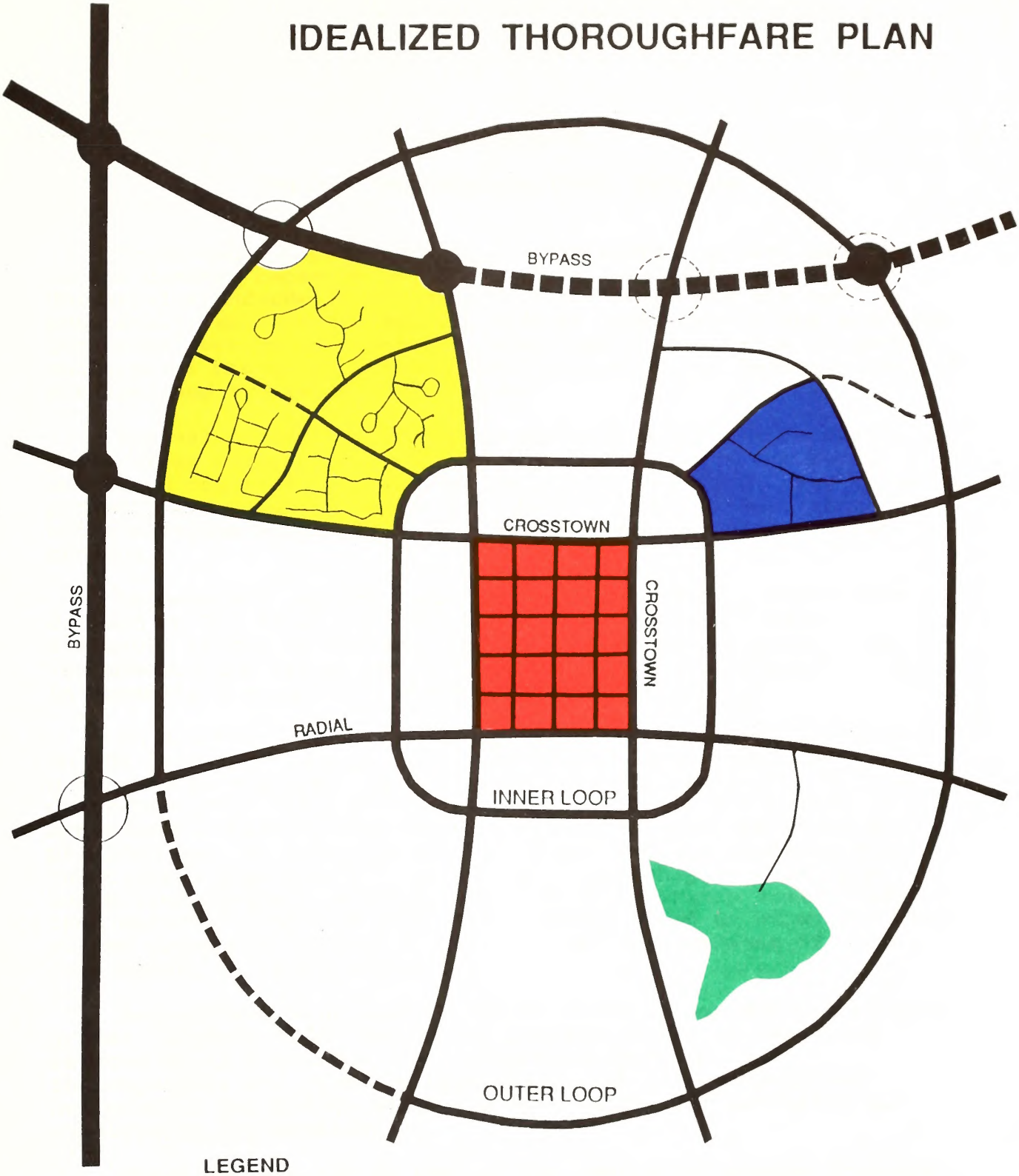
Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the size of the urban area. They are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic which has no desire to be in the city. Bypasses are usually designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volumes can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through-traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, a thoroughfare plan is developed for established urban areas and is constrained by the existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these constraints and the many other factors that affect major street locations.

IDEALIZED THOROUGHFARE PLAN



LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE FREEWAY		
MAJOR OTHER		
MINOR THOROUGHFARE		
LOCAL ROAD		
INTERCHANGE		
GRADE SEPERATION		

LAND USES

- COMMERCIAL/BUSINESS
- RESIDENTIAL
- INDUSTRIAL
- PUBLIC/INSTITUTIONAL

FIGURE 14

Appendix B

Typical Thoroughfare Cross Sections

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way.

Typical cross section recommendations are shown in **Figure 15.** These cross sections are typical for facilities on new location and where right-of-way constraints are not critical. For widening projects and urban projects with limited right-of-way, special cross sections should be developed that meet the needs of the project.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way. The recommended typical cross sections for the thoroughfares are given in **Appendix D** along with other pertinent information.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate right-of-way should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each thoroughfares are listed in **Appendix D.** Recommendations for "ultimate" cross sections are provided for (1) thoroughfares which may require widening after the current planning period; (2) for thoroughfares which are borderline adequate and accelerated traffic growth could render them deficient; and (3) for thoroughfares where an urban curb and gutter cross section may be locally desirable because of urban development or redevelopment.

Recommended design standards relating to maximum and minimum grades, minimum sight distances, maximum degree of curve and related super elevation, and other considerations for thoroughfares are given in **Appendix D.** This Appendix gives definitions and design standards recommended for inclusion in subdivision regulations.

Cross section "A" is typical for controlled access freeways. The 14 m (46′) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228′) depending upon cut and fill requirements.

Cross section "B" is typical for four lane divided highways in rural areas which may have only partial or no control of

access. The minimum median width for this cross section is 14 m (46′), but a wider median is desirable. Design requirements for slopes and drainage would be similar to cross section "A", but there may be some variation from this depending upon right-of-way constraints.

Cross section "C", seven lane urban, should not be used for new projects. When the conditions warrant six lanes, cross section "E" should be recommended. Cross section "C" should be used only in special situations such as when widening from a five lane section and right-of-way is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "E" is the final cross section.

Cross section "D", five lane urban, is typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "E" and "F" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.8 m (16′) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

Cross section "G" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24′) is recommended with 9.1 m (30′) being desirable.

Typical cross section "H" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "I". Cross sections "J" and "K" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "J" would be used on those minor thoroughfares where parking on

both sides is needed as a result of more intense development.

Cross section "L" is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full right-of-way of 30 m (100') should be required. In some instances, local ordinances may not allow the full 30 m (100'). In those cases, 21 m (70') should be preserved with the understanding that the full 30 m (100') will be preserved by use of building setbacks and future street line ordinances.

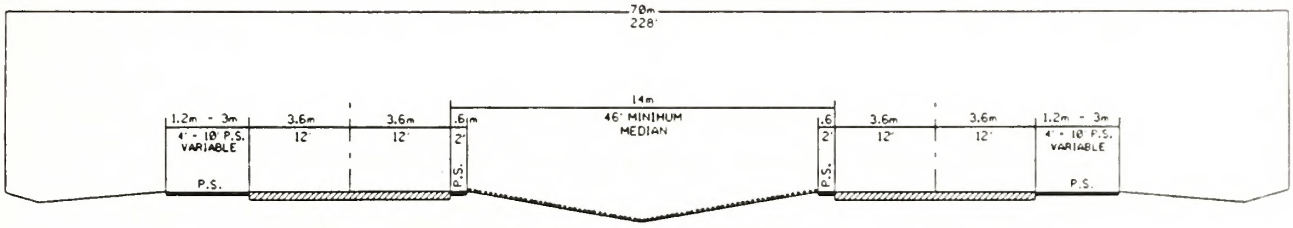
The urban curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The right-of-ways shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities. Cross sections O, P and Q are typically used to accommodate bicycle travel.

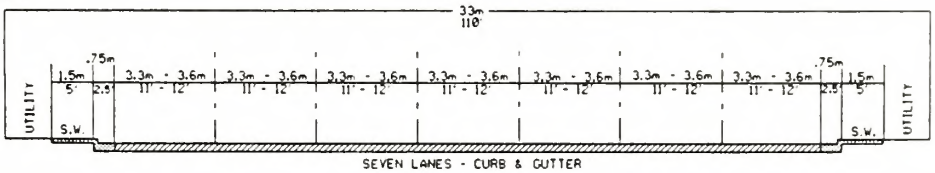
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



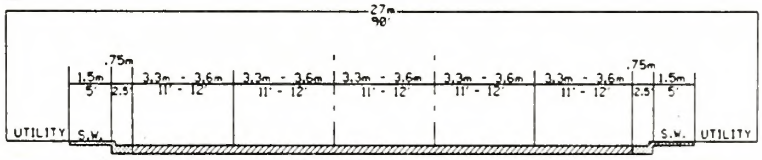
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



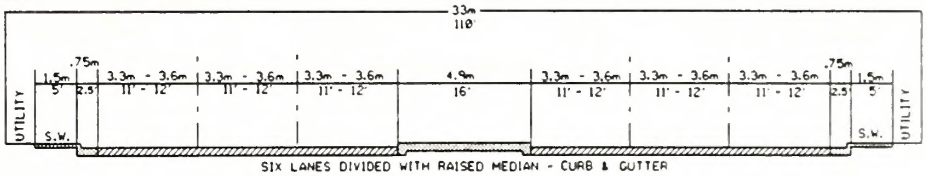
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

D.

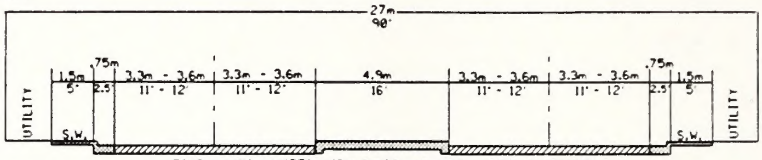


SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

FIGURE 15

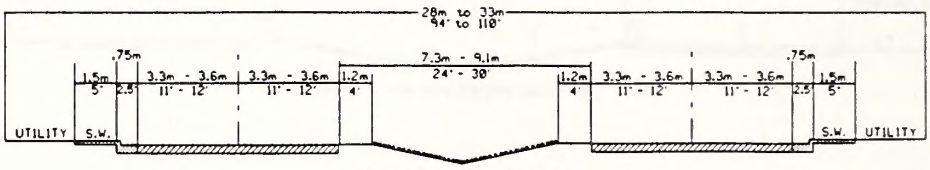
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



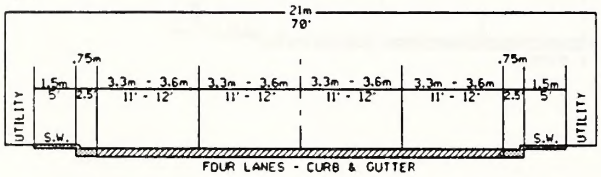
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



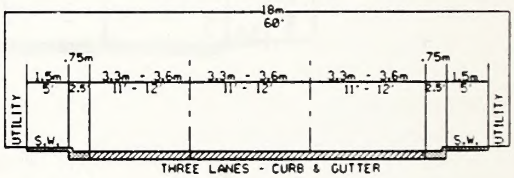
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



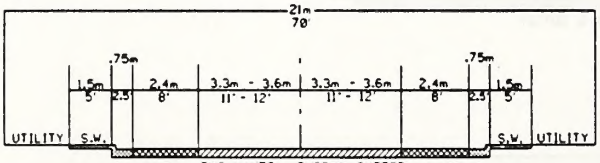
FOUR LANES - CURB & GUTTER

H.



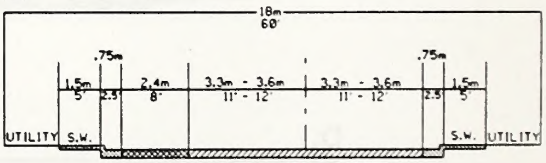
THREE LANES - CURB & GUTTER

I.



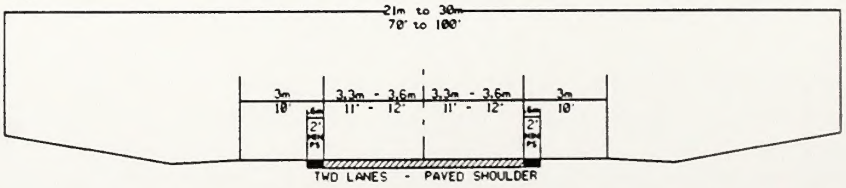
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

K.

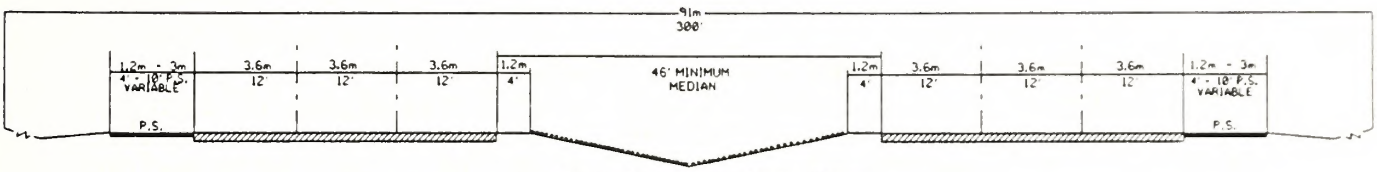


TWO LANES - PAVED SHOULDER

FIGURE 15

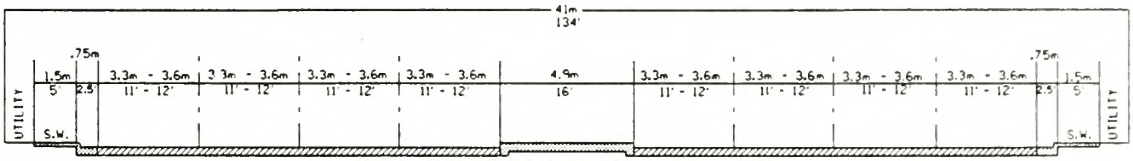
TYPICAL THOROUGHFARE CROSS SECTIONS

L.



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

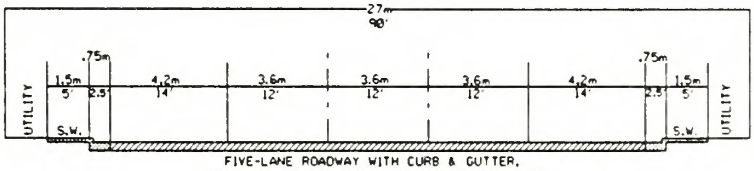
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

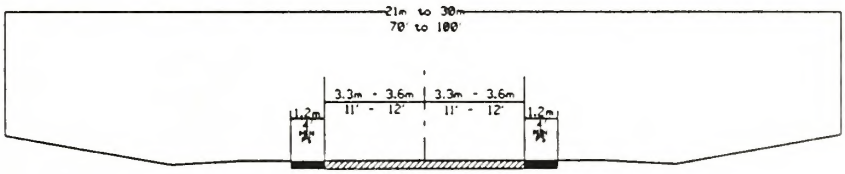
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



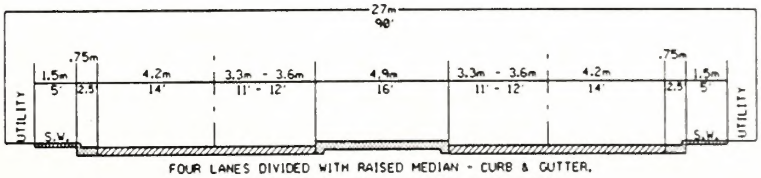
FIVE-LANE ROADWAY WITH CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

FIGURE 15

Appendix C

Thoroughfare Plan Street Inventory and Recommendations

The following recommendations are based on the "Mutually Adopted Thoroughfare Plan". The 2020 design year traffic volumes reflect the expected traffic patterns assuming a completely implemented plan. Since projects will be constructed in stages, variations in these patterns should be expected.

Legend

Adq - Adequate
Cap - Capacity at Level of Service D
NA - Not available
ABCD - Proposed Facility
NPAB - Northern Planning Area Boundary
SPAB - Southern Planning Area Boundary
EPAB - Eastern Planning Area Boundary
WPAB - Western Planning Area Boundary

Section	Present					Future			
	Dist (km)	Rdwy (m)	ROW (m)	Cap (veh)	1990 ADT	Cap (veh)	2020 ADT	Rdwy XSec	ROW (m)
I-85									
NPAB - US 29/74	0.97	14.4	45	54000	38500	108000	106000	8lan	91
US 29/74 - NC 161	3.55	14.4	78	54000	25200	80000	69000	L	91
NC 161 - SR 2283	4.65	14.4	90	54000	26800	80000	72000	L	Adq
SR 2283 - US 29	2.38	14.4	90	54000	25800	80000	67000	L	Adq
US 29 - SPAB	1.94	14.4	90	54000	24000	80000	59000	L	Adq
US 29									
NPAB - I-85	0.65	14.4	45	24000	12300	80000	29900	L	91
I-85 - NC 216	0.71	14.4	78	24000	NA	Adq	8500	Adq	Adq
NC 216 - SPAB	1.55	14.4	63	24000	5000	Adq	14900	Adq	Adq
US 74									
I-85 - US 74 Bus.	1.32	16.8	30	54000	21200	80000	52000	L	91
US 74 Bus. - NC 216	6.58	25.2	120	54000	18700	80000	45000	L	Adq
NC 216 - SR 2026	2.07	16.8	111	54000	15600	80000	48000	L	Adq
SR 2026 - US 74 Bus.	4.97	16.8	111	54000	14400	80000	43900	L	Adq
US 74 Bus. - WPAB	0.65	14.4	60	54000	20400	80000	49700	L	91
US 74 Bus.									
US 74 - NC 161	1.10	9.6	30	14000	6200	Adq	11000	Adq	Adq
NC 161 - NC 216	1.10	9.6	30	14000	9800	Adq	14800	Adq	Adq
NC 216 - Mountain St.	1.74	10.8	30	14000	NA	Adq	13000	Adq	Adq
Mountain St. - US 74	4.71	14.4	45	24000	7600	Adq	12000	Adq	Adq
NC 161									
NPAB - **NC 161/216 Conn.**	2.38	7.2	18	12000	5200	24000	13100	F	33
NC 161/216 Conn - US 74	1.75	15.6	30	24000	9800	Adq	9200	Adq	Adq
US 74 - Ridge St.	0.58	20.4	30	24000	10900	28000	19100	N	Adq
Ridge St. - US 74 Bus.	0.19	9.0	18	14000	NA	28000	19100	N	27
US 74 Bus. - I-85	1.74	13.5	18	14000	11700	28000	24700	N	27
I-85 - SR 1104	0.77	14.4	18	12000	8400	24000	15000	F	33
SR 1104 - SPAB	4.71	7.2	100	12000	5100	24000	10300	F	Adq
NC 216									
NPAB - SR 2013	1.38	7.2	18	12000	3500	Adq	8500	Adq	Adq
SR 2013 - SR 1400	2.60	7.2	18	12000	4900	24000	11500	F	33
SR 1400 - US 74	1.50	7.2	18	12000	4900	24000	10500	G	21
US 74 - Battleground Rd.	0.71	15.6	21	24000	NA	Adq	15000	Adq	Adq
Battleground - US 74 Bus	0.58	9.6	18	12000	3600	Adq	5500	Adq	Adq
US 74 Bus. - US 29	7.67	7.2	18	12000	5200	Adq	7500	Adq	Adq
NC 161/216 Connector									
NC 161 - NC 216	**1.10**					**12000**	**6800**	**K**	**30**

1 meter (m) = 3.28 feet 1 kilometer (km) = 0.62 miles

SECTION	Present					Future			
	Dist (km)	Rdwy (m)	ROW (m)	Cap (veh)	1990 ADT	Cap (veh)	2020 ADT	Rdwy XSec	ROW (m)
Bethel Church Rd. (SR2250)									
SR 2245 - US 74	3.10	5.4	18	8500	1400	Adq	2300	Adq	Adq
Baker St.									
NC 216 - Battleground Rd	0.32	7.8	15	9000	600	Adq	900	Adq	Adq
Battleground Rd.									
NC 216 - Baker St.	0.52	5.4	12	9500	NA	Adq	900	Adq	Adq
Cansler Ave. (SR 2025)									
NC 216 - Walker St.	2.19	5.4	15	8500	2800	Adq	6500	Adq	Adq
Walker St. - US 74 Bus.	0.97	15.6	24	18000	NA	Adq	6000	Adq	Adq
US 74 Bus. - Gold St.	0.32	15.6	24	18000	NA	Adq	5500	Adq	Adq
Chestnut Rdg (SR 1407/2019									
NPAB - NC 216	2.19	5.4	18	8500	700	Adq	1700	Adq	Adq
Dixon School Rd. (SR 2283)									
NC 216 -**Dixon Sch Rd Ext**	1.63	5.4	18	8500	2200	Adq	4800	Adq	Adq
Dixon Sch Rd Ext - I-85	0.50	5.4	18	8500	1800	24000	12000	F	33
I-85 - SPAB	2.45	5.4	18	8500	1300	Adq	3100	Adq	Adq
Dixon School Rd Extension									
TIP R-2625	**3.50**					**24000**	**11000**	**F**	**33**
US 74 Bus. - US 74	**1.90**					**12000**	**7400**	**K**	**33**
US 74 - NC 216	**3.75**					**12000**	**8000**	**K**	**33**
Fairview Ave.									
NC 216 - NC 161	1.16	8.7	9	12000	2600	Adq	3500	Adq	Adq
Freedom Mill Rd. (SR 1106)									
EPAB - SR 1125	0.77	5.4	18	8500	2000	Adq	4900	Adq	Adq
Gaston St.									
Gold St. - NC 216	0.97	8.7	15	12000	500	Adq	6000	Adq	Adq
Gold St.									
SR 2256 - NC 216	1.55	7.8	12	12000	1900	Adq	7000	Adq	Adq
NC 216 - Gaston St.	0.19	13.2	15	14000	NA	Adq	9000	Adq	Adq
Gaston St. - NC 161	0.71	7.8	15	12000	NA	Adq	10600	Adq	Adq
NC 161 - Dade Loop	0.70	7.8	15	12000	NA	Adq	5000	Adq	Adq
Gold St. Extension									
Dade Loop - US 74 Bus.	**0.40**					**12000**	**5000**	**K**	**30**
Hawthorne Rd.									
Railroad St. - NC 216	0.05	7.5	9	9500	500	Adq	800	Adq	Adq

SECTION	Present					Future			
	Dist (km)	Rdwy (m)	ROW (m)	Cap (veh)	1990 ADT	Cap (veh)	2020 ADT	Rdwy XSec	ROW (m)
Kinder Mfg./Linder Rd. (SR 1483/2021)									
NC 161 - Fairview Ave.	2.45	9.6	18	12000	2700	Adq	3000	Adq	Adq
Lewis Rd. (SR 1401)									
NPAB - NC 161	2.13	5.4	18	8500	1000	Adq	1800	Adq	Adq
Lk. Montonia (SR2292/1104)									
NC 161 - SR 1125	5.81	5.4	18	8500	3400	Adq	5400	Adq	Adq
Lovelace Rd. (SR 2039)									
WPAB - SR 2033	1.74	5.4	18	8500	300	Adq	700	Adq	Adq
Margrace Rd. (SR 2263)									
US 29 - SR 2245	2.06	5.4	18	8500	1000	Adq	2500	Adq	Adq
SR 2245 - NC 216	4.19	5.4	18	8500	1900	Adq	6000	Adq	Adq
Midway Rd. (SR 2245)									
WPAB - NC 216	2.84	6.0	18	10500	1900	Adq	6000	Adq	Adq
NC 216 - SPAB	2.45	6.0	18	10500	800	Adq	2000	Adq	Adq
Moore Rd. (SR 2013)									
NPAB - NC 216	1.87	6.0	18	10500	800	Adq	1900	Adq	Adq
Mountain St.									
US 74 - Cansler St.	1.42	9.3	15	12000	NA	Adq	9000	Adq	Adq
Cansler St. - NC 216	0.26	9.3	15	12000	2100	Adq	5500	Adq	Adq
NC 216 - Gaston St.	0.38	9.3	15	12000	NA	Adq	2000	Adq	Adq
Oak Grove (SR 2033)									
WPAB - SR 2015	3.75	6.6	18	11000	3300	Adq	8000	Adq	Adq
SR 2026 - NC 216	1.94	5.4	18	8500	1200	Adq	3500	Adq	Adq
Old Kings Mtn. Rd./Long Cr Church Rd. (SR1400/2020)									
SR 1401 - NC 216	2.71	5.4	18	8500	NA	Adq	2500	Adq	Adq
Patterson Grove (SR 2035)									
SR 2033 - SR 2026	1.94	5.4	18	8500	1600	Adq	3000	Adq	Adq
Phifer Rd. (SR 2256)									
SR 2245 - CL	2.18	5.4	18	8500	4000	Adq	7000	Adq	Adq
CL - Mountain St.	1.50	5.4	18	8500	6200	14000	10000	H	Adq
Piedmont Ave.									
Gold St. - NC 216	0.77	7.2	15	12000	NA	Adq	2000	Adq	Adq

SECTION	Present					Future			
	Dist (km)	Rdwy (m)	ROW (m)	Cap (veh)	1989 ADT	Cap (veh)	2020 ADT	Rdwy XSec	ROW (m)
Pinnacle Rd. (SR 1125)									
EPAB - SR 1106	2.84	6.0	18	10000	3400	Adq	8300	Adq	Adq
SR 1106 - SPAB	3.94	6.0	18	10000	700	Adq	1900	Adq	Adq
Putnam Store Rd. (SR 2015)									
NPAB - SR 2033	1.61	5.4	18	8500	400	Adq	900	Adq	Adq
Railroad Ave.									
US 74 Bus. - Hawthorne	0.82	6.3	12	9000	NA	Adq	2000	Adq	Adq
Ridge St.									
NC 216 - NC 216	1.10	9.3	15	12000	NA	Adq	2000	Adq	Adq
Scism Rd. (SR 2032)									
SR 2033 - SR 2026	1.87	6.0	18	10000	NA	Adq	3200	Adq	Adq
Spectrum Rd. (SR 2034)									
SR 2033 - SR 2035	2.06	5.4	18	8500	NA	Adq	6000	Adq	Adq
SR 2035 - SR 2026	2.58	5.4	18	8500	400	12000	9500	K	30
Unity Church Rd. (SR 1102)									
SPAB - SR 1104	1.10	6.0	18	10000	100	Adq	300	Adq	Adq
Waco Rd. (SR 2026)									
SR 2033 - US 74	1.48	5.4	15	8500	5000	Adq	6000	Adq	Adq
US 74 - Watterson St.	1.32	12.6	18	12000	NA	Adq	8000	Adq	Adq
Cansler St. - NC 216	0.52	7.2	15	12000	NA	Adq	2000	Adq	Adq
Walker St.									
Waco Rd. - Cansler St.	0.32	7.2	12	12000	NA	Adq	4000	Adq	Adq
Ware Rd. (SR 2252)									
SR 2250 - SR 2263	1.94	6.0	18	10000	800	Adq	2000	Adq	Adq
Watterson St.									
Walker St. - US 74 Bus.	0.97	7.8	18	12000	NA	Adq	6500	Adq	Adq
US 74 Bus. - Gold St.	0.32	7.8	18	12000	600	Adq	2500	Adq	Adq

Appendix D

Planning Area Socio-Economic Data

1990 Housing Data and Commercial Vehicle Data*

Zone	Excellent	Above Average	Average	Below Average	Poor	Trucks	Cars	Total DU's
1	0	18	8	7	4	5	1	37
2	0	0	26	52	26	5	2	104
3	0	0	9	90	45	0	0	144
4	0	1	29	30	15	0	0	75
5	0	0	16	1	0	24	27	17
6	0	0	20	8	4	11	2	32
7	0	0	9	32	16	3	0	57
8	0	0	8	3	1	12	2	12
9	0	1	1	2	1	10	0	5
10	0	0	0	74	37	56	13	111
11	0	0	18	11	5	5	1	34
12	0	1	17	75	37	9	5	130
13	0	1	0	0	0	45	5	1
14	0	0	12	8	4	10	0	24
15	0	0	11	22	11	23	0	44
16	0	0	32	30	15	1	1	77
17	0	0	38	3	2	0	0	43
18	0	0	21	30	15	4	0	66
19	0	1	41	79	40	6	9	161
20	0	0	29	9	5	0	0	43
21	0	0	18	59	29	1	3	106
22	1	1	23	27	14	0	0	66
23	0	0	18	7	3	3	1	28
24	0	0	25	120	60	60	6	205
25	0	0	33	9	4	3	0	46
26	0	1	19	65	33	3	0	118
27	0	0	252	7	3	2	2	262
28	0	7	49	13	6	2	0	75
29	0	0	11	176	88	3	0	275
30	0	0	3	3	1	0	0	7
31	0	0	4	9	5	8	4	18
32	0	0	4	73	36	0	0	113
33	0	2	8	43	21	8	0	74
34	0	0	100	44	22	3	0	166
35	0	0	3	90	45	10	4	138
36	0	0	8	22	11	2	0	41
37	0	1	24	16	8	0	0	49
38	0	0	49	10	5	6	0	64
39	0	28	45	0	0	0	0	73
40	0	0	175	30	15	2	2	220
41	0	0	35	8	4	11	0	47
42	0	0	22	0	0	0	2	22
43	0	0	36	73	36	0	0	145

1990 Housing and Commercial Vehicle Data*

ZONE	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	Trucks	Cars	TOTAL DU'S
44	0	0	16	0	0	5	0	16
45	0	0	22	20	10	1	0	52
46	0	0	122	0	0	0	0	122
47	1	1	5	9	4	1	0	20
48	0	0	13	7	3	0	0	23
49	0	0	5	1	1	0	0	7
50	0	51	26	15	7	0	0	99
51	0	0	15	1	0	3	0	16
52	0	0	24	35	17	3	0	76
53	0	0	33	8	4	20	0	45
54	0	28	17	34	17	5	0	96
55	0	0	5	0	0	0	0	5
56	0	0	13	0	0	0	0	13
57	0	0	256	42	21	4	0	319
58	0	0	3	43	21	2	0	67
59	0	0	2	4	2	0	0	8
60	0	1	80	156	78	8	0	315
61	0	0	80	34	17	0	0	131
62	0	0	19	55	28	5	0	102
63	0	0	156	11	5	1	1	172
64	0	0	36	15	7	1	0	58
65	0	0	33	5	3	3	0	41
66	0	0	67	46	23	19	0	136
67	0	19	108	34	17	1	0	178
68	0	0	23	6	3	3	0	32
69	0	0	12	6	3	76	5	21
70	0	0	30	92	46	0	0	168
71	0	0	41	152	76	0	0	269
72	0	0	0	2	1	8	0	3
73	0	1	17	20	10	1	0	48
74	0	0	28	3	1	16	2	32
75	0	1	61	41	20	4	0	123

* The raw housing data collected by Isothermal for Average (Avg), Below Average (BAvg), and Poor was adjusted due to the large number of units classified as Below Average and Poor. The adjusted numbers are shown in the table above. The following equations were used to make the adjustments:

Adjusted Avg = Collected Avg + Collected BAvg
Adjusted BAvg = Collected Poor x 0.67
Adjusted Poor = Collected Poor x 0.33

1990 Employment Data

Zone	Industrial	Other Retail/ Wholesale	Highway Retail	Financial/ Administrative	Service	Hospital	Total
1	0	14	5	0	51	0	70
2	0	7	50	7	32	0	96
3	6	6	0	0	3	0	15
4	0	2	0	2	0	0	4
5	19	71	16	117	97	0	320
6	16	10	0	22	23	0	71
7	4	61	22	5	6	0	98
8	97	2	0	0	3	0	102
9	317	0	0	0	0	0	317
10	949	0	12	0	16	0	977
11	221	0	0	0	3	0	224
12	0	15	6	37	10	0	68
13	99	3	6	0	35	0	143
14	18	0	0	0	0	0	18
15	6	10	0	10	7	0	33
16	350	7	10	0	1	0	458
17	0	0	0	0	0	0	0
18	0	5	0	0	1	0	6
19	0	0	0	0	28	0	28
20	0	0	0	0	0	0	0
21	0	0	0	0	7	0	7
22	0	0	0	0	12	0	12
23	0	5	0	0	8	0	13
24	346	9	0	0	4	0	359
25	19	0	5	0	3	0	27
26	0	7	5	0	40	0	52
27	0	13	0	0	10	0	23
28	0	12	0	3	3	0	18
29	61	1	2	0	6	0	70
30	0	0	0	0	0	0	0
31	70	23	6	0	15	0	114
32	0	3	0	0	4	0	7
33	56	1	11	0	7	0	75
34	2	2	0	0	3	0	7
35	60	0	2	0	37	0	106
36	130	0	0	0	15	0	145
37	0	12	0	31	13	0	56
38	97	0	0	0	0	0	97
39	0	0	0	0	0	0	0
40	0	7	0	0	66	0	73
41	0	0	0	0	126	0	126
42	6	7	0	43	40	230	326
43	0	4	3	0	1	0	8
44	0	7	0	0	0	0	7
45	0	0	37	0	21	0	58
46	0	0	0	0	0	0	0
47	71	0	0	0	0	0	71

1990 Employment Data

Zone	Industrial	Other Retail/ Wholesale	Highway Retail	Financial/ Administrative	Service	Hospital	Total
48	256	0	0	0	0	0	256
49	0	0	0	0	0	0	0
50	0	26	0	0	12	0	38
51	15	0	0	0	0	0	15
52	3	0	1	0	10	0	14
53	2	30	23	3	4	0	62
54	1	9	0	0	6	0	16
55	0	0	0	0	200	0	200
56	0	0	0	0	0	0	0
57	50	0	0	0	0	0	50
58	25	0	0	0	0	0	25
59	0	0	0	0	0	0	0
60	31	3	0	0	9	0	43
61	0	1	0	0	7	0	8
62	10	0	0	0	3	0	13
63	40	0	0	0	3	0	43
64	397	0	0	0	0	0	397
65	0	0	2	0	3	0	5
66	26	2	0	0	2	0	30
67	3	0	0	0	0	0	3
68	21	0	0	0	0	0	21
69	0	0	0	85	3	0	88
70	0	0	0	0	70	0	70
71	0	2	0	0	7	0	9
72	310	0	0	0	3	0	313
73	11	0	0	0	4	0	15
74	609	1	0	0	0	0	610
75	0	0	0	0	7	0	7

2020 Housing Data and Commercial Vehicle Data

Zone	Excellent	Above Average	Average	Below Average	Poor	Trucks	Cars	Total DU's
1	0	18	8	7	4	7	1	37
2	0	0	26	64	28	7	3	118
3	0	0	9	101	48	0	0	158
4	0	1	30	30	15	0	0	76
5	0	0	16	1	0	32	36	17
6	0	3	20	8	4	15	3	35
7	0	0	10	32	16	4	0	58
8	0	0	9	3	1	16	3	13
9	0	1	2	2	1	14	0	6
10	0	0	1	74	37	76	18	112
11	0	9	18	11	5	7	1	43
12	1	11	17	75	37	12	7	141
13	0	1	2	0	0	61	7	3
14	0	7	18	13	4	14	0	42
15	0	0	32	32	11	31	0	75
16	0	0	32	35	16	1	1	83
17	0	6	38	3	2	0	0	49
18	0	0	21	35	16	5	0	72
19	1	6	41	79	40	8	12	167
20	0	0	29	9	5	0	0	43
21	0	0	18	64	31	1	4	113
22	2	6	23	27	14	0	0	72
23	0	6	18	7	3	4	1	34
24	0	0	80	145	65	81	8	290
25	0	0	39	9	4	4	0	52
26	1	11	21	88	36	4	0	157
27	0	39	252	7	3	3	3	301
28	3	72	53	19	6	3	0	153
29	0	0	71	187	95	4	0	353
30	0	0	25	7	1	0	0	43
31	0	0	4	9	5	11	5	18
32	0	0	4	73	36	0	0	113
33	1	8	8	43	21	11	0	81
34	0	27	100	44	22	4	0	193
35	0	0	3	94	48	14	5	145
36	0	0	8	22	11	3	0	41
37	0	1	24	16	8	0	0	49
38	0	0	49	10	5	8	0	64
39	13	56	45	0	0	0	0	114
40	0	3	175	30	15	3	3	223
41	0	8	35	8	4	15	0	55
42	0	0	22	0	0	0	3	22
43	0	0	36	84	39	0	0	159
44	0	8	139	0	0	7	0	147
45	3	12	22	20	10	1	0	67
46	3	12	122	0	0	0	0	137
47	2	19	14	14	4	1	0	53

2020 Housing and Commercial Vehicle Data

ZONE	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	Trucks	Cars	TOTAL DU'S
48	3	16	34	11	3	0	0	67
49	0	3	39	5	1	0	0	48
50	24	71	26	15	7	0	0	143
51	0	8	45	4	0	4	0	57
52	0	0	50	49	18	4	0	117
53	0	18	33	10	4	27	0	65
54	13	74	17	34	17	7	0	155
55	0	3	96	0	0	0	0	99
56	0	7	59	0	0	0	0	66
57	0	20	256	42	21	5	0	339
58	0	0	3	46	23	3	0	72
59	0	0	90	10	2	0	0	102
60	1	11	87	211	84	11	0	394
61	0	44	80	35	18	0	0	177
62	0	0	35	55	28	7	0	118
63	0	46	156	11	5	1	1	218
64	0	21	155	23	8	1	0	207
65	0	18	159	10	3	4	0	190
66	0	0	223	65	25	26	0	313
67	9	193	108	37	17	1	0	364
68	0	13	92	18	3	4	0	126
69	0	7	45	18	3	103	7	73
70	0	0	84	125	50	0	0	259
71	0	0	41	172	82	0	0	295
72	0	0	7	8	1	11	0	16
73	1	11	47	30	11	1	0	100
74	0	15	34	8	1	22	3	58
75	1	11	209	57	22	5	0	300

2020 Employment Data

Zone	Industrial	Other Retail/ Wholesale	Highway Retail	Financial/ Administrative	Service	Hospital	Total
1	0	14	5	0	51	0	70
2	0	7	50	7	32	0	96
3	6	6	0	0	3	0	15
4	0	15	13	2	0	0	30
5	19	71	16	117	97	0	320
6	16	10	0	22	23	0	71
7	4	93	52	5	6	0	160
8	142	32	0	0	3	0	177
9	404	0	0	0	0	0	404
10	999	11	22	10	16	0	1058
11	245	0	0	0	3	0	248
12	11	15	6	49	10	0	91
13	140	18	6	0	60	0	224
14	99	0	0	0	0	0	99
15	67	20	10	10	7	0	114
16	910	17	40	0	16	0	983
17	605	0	0	0	0	0	605
18	575	25	0	0	1	0	601
19	0	10	0	0	38	0	48
20	0	0	0	0	5	0	5
21	0	10	10	0	7	0	27
22	66	20	15	0	12	0	113
23	0	25	10	0	18	0	53
24	386	39	10	10	14	0	512
25	19	0	25	0	3	0	47
26	0	7	5	0	40	0	52
27	0	13	0	0	10	0	23
28	20	12	0	3	3	0	38
29	91	1	2	0	6	0	100
30	0	0	0	0	0	0	0
31	70	23	6	0	15	0	114
32	12	3	0	0	4	0	19
33	56	1	24	0	7	0	85
34	2	2	0	0	3	0	7
35	66	7	2	0	37	0	112
36	130	0	0	0	15	0	145
37	0	12	0	37	19	0	68
38	97	0	0	0	0	0	97
39	0	0	0	0	3	0	3
40	0	7	0	0	66	0	141
41	0	0	0	0	139	0	139
42	6	7	0	43	40	242	338
43	0	4	3	0	1	0	8
44	0	7	0	0	0	0	7
45	0	0	46	0	21	0	67
46	0	0	0	0	9	0	9
47	71	0	15	0	10	0	96

2020 Employment Data

Zone	Industrial	Other Retail/ Wholesale	Highway Retail	Financial/ Administrative	Service	Hospital	Total
48	284	0	15	0	0	0	299
49	0	16	0	0	0	0	16
50	0	30	0	0	16	0	46
51	15	0	16	0	0	0	31
52	3	6	6	0	15	0	30
53	2	30	23	7	9	0	71
54	1	13	4	0	6	0	24
55	0	0	0	0	200	0	200
56	0	0	0	0	0	0	0
57	50	0	0	0	0	0	50
58	49	0	0	0	0	0	49
59	0	0	0	0	0	0	0
60	31	3	0	0	9	0	43
61	0	1	0	0	7	0	8
62	43	0	0	0	3	0	46
63	40	0	0	0	3	0	43
64	447	0	0	0	0	0	447
65	0	20	12	10	13	0	55
66	26	22	0	0	12	0	60
67	3	20	0	0	10	0	33
68	83	0	0	0	0	0	83
69	15	0	0	85	3	0	103
70	0	0	0	0	70	0	70
71	0	2	0	0	7	0	9
72	310	0	0	0	3	0	313
73	11	0	0	0	4	0	15
74	644	1	0	0	0	0	645
75	0	17	0	10	7	0	34

Appendix E

Recommended Subdivision Ordinances

Definitions

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.

4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Interstate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through-traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway - Divided multilane roadways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally with grade separations at major intersections. A parkway is for non-commercial traffic, with full or partial control of access.

2. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. Local Residential Street - Cul-de-sacs, loop streets less than 750 meters in length, or streets less than one and a half kilometers in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

5. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

6. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides of develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than ten acres where no street right-of-way dedication is involved, (3) the public acquisition, by purchase, of strips of land for the widening or the opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than two acres into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

Design Standards

I. Streets and Roads

The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the municipality.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

		Min. ROW
1.	Rural	
	a. Principle Arterial	
	Freeways	105 meters
	Other	60 meters
	b. Minor Arterial	30 meters
	c. Major Collector	30 meters
	d. Minor Collector	24 meters
	e. Local Road	18 meters[1]
2.	Urban	
	a. Major Thoroughfare other than Freeway and Expressway	27 meters
	b. Minor Thoroughfare	21 meters
	c. Local Street	18 meters[1]
	d. Cul-de-sac	Variable[2]

The subdivider will only be required to dedicate a maximum of 30 meters of right-of-way. In cases where over 30 meters of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 30 meters. On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than eighteen meters in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is sub-divided, the remainder of the full required right-of-way shall be dedicated.

[1] The desirable minimum right-of-way (ROW) is 18 meters. If curb and gutter is provided, 15 meters of ROW is adequate on local residential streets.

[2] The ROW dimension will depend on radius used for vehicular turn around. Distance from edge of pavement of turn around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and Gutter section: 7.8 meters, face to face of curb
   Shoulder section: 6 meters to edge of pavement, 1.2 meters for shoulders

2. Residential Collector
   Curb and Gutter section: 10.2 meters, face to face of curb
   Shoulder section: 6 meters to edge of pavement, 1.8 meters for shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 10 km/h greater than the posted speed limit. The design speeds for subdivision type streets shall be:

Design Speeds

Facility Type	Design Speed km/h Desirable	Minimum Level	Minimum Rolling
Rural			
Minor Collector Roads	100	80	70
Local roads including Residential Collectors and Local Residential	80	80	70
Urban			
Major Thoroughfares other than Freeway or Expressway	100	80	80
Minor Thoroughfares	100	80	70
Local Streets	70	70	50

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

Maximum Vertical Grade				
Facility Type	Design Speed (km/h)	Maximum Grade (Percent) Flat	Rolling	Mountainous
Rural				
Minor Collector Roads*	30	7	10	12
	50	7	9	10
	60	7	8	10
	90	6	7	9
	100	5	6	8
	110	4	5	6
Local roads including Residential Collectors and Local Residential Streets*	30	-	11	16
	50	7	10	14
	60	7	9	12
	90	6	8	10
	100	5	6	-
Urban				
Major Thoroughfares other than Freeway or Expressway	50	8	9	11
	60	7	8	10
	90	6	7	9
	100	5	6	8
Minor Thoroughfares*	30	9	10	12
	50	9	9	10
	60	9	8	10
	90	7	7	9
	100	6	6	8
	110	5	5	6
Local Streets*	30	-	12	17
	50	8	11	15
	60	8	10	13
	90	7	9	11
	100	6	7	-

b. Minimum grade should not be less than 0.5% .

c. Grades for 30 meters each way from intersections (measured from edge of pavement) should not exceed 5%.

* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters long, grades may be 2% steeper than the values in the above table.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

Sight Distance					
Design Speed (km/h)	30	50	60	90	100
Stopping Sight Distance					
Minimum (meters)	30	60	80	140	160
Desirable Minimum (meters)	30	70	90	170	210
Minimum K* Value for:					
Crest curve	3	10	18	71	105
Sag curve	4	12	18	40	51

(General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.)

4. The "Superelevation Table" shown below and continued on the next page shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

Superelevation Table		
Design Speed (km/h)	Maximum e	Minimum Radius (meters)
50	0.04	100
60	0.04	150
90	0.04	375
100	0.04	490

* K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

Superelevation Table continued		
Design Speed (km/h)	Maximum e	Minimum Radius (meters)
50	0.06	90
60	0.06	135
90	0.06	335
100	0.06	435
50	0.08	80
60	0.08	125
90	0.08	305
100	0.08	395

e = rate of roadway superelevation, meter per meter

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than one hundred and fifty (150) meters in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least six (6) meters.

3. Deadend alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the deadend as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9 meters from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

a. Shoulder section approach

i. Under 800 ADT design year

Minimum 8.4 meters width face to face of parapets, rails, or pavement width plus 3 meters, whichever is greater.

ii. 800 - 2000 ADT design year

Minimum 10.2 meters width face to face of parapets, rails, or pavement width plus 3.6 meters, whichever is greater.

iii. Over 2000 ADT design year

Minimum width of 12 meters, desirable width of 13.2 meters width face to face of parapets or rails.

b. Curb and gutter approach

i. Under 800 ADT design year

Minimum 7.2 meters face to face of curbs.

ii. Over 800 ADT design year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 m minimum, 3 m desirable.)

b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

Appendix F

Public Involvement

Kings Mountain
Thoroughfare Planning Committee

- Steve Killian
  Kings Mountain Planning Director
- Jeff Putnam
  Kings Mountain Director of Inspections
- Scott Neisler
  Mayor of the City of Kings Mountain
- Valarie Boyd
  Citizen, Kings Mountain
- Jim Childers
  Citizen, Kings Mountain
- Al Moretz
  Citizen, Kings Mountain
- Johnny Reavis
  Citizen, Kings Mountain

Goals and Objectives Survey Results
City of Kings Mountain

The Kings Mountain Goals and Objectives Survey was conducted in December, 1995. It incorporated two formats for deriving information.

The first part of the survey consisted of two categories in which the participant ranked related issues in order of priority. There were a range of issues covered including environmental issues, economic issues, neighborhood issues, and transportation issues. The purpose of this section was to introduce the public to the concept of making trade-offs between conflicting issues, many of which they may view as important.

The second part of the survey was designed to solicit responses to various transportation concerns in the Kings Mountain area. Four questions were included. An open-ended structure was used to encourage participants to respond freely.

The survey was distributed to the Thoroughfare Planning Committee and the Kings Mountain Chamber of Commerce. A notice was placed in the local newspaper to inform the public that surveys were available at Kings Mountain City Hall. There were a total of 12 responses.

The following is a summary of the survey. Average response ratings for the first part are given with 1 being the most important and 5 being the least important. Each response for the open-ended questions is listed following the question. These results were used in the development of the recommendations for the Kings Mountain area.

Part I

A road's ability to carry traffic should be increased by:

Average
Response (rated from 1, most important, to 5, least important)

1.6	Making improvements to the intersections
1.8	Building additional traffic lanes
2.6	Controlling strip development
4.4	Encouraging people to ride together
4.9	Providing public transportation
4.4	Providing alternative modes of travel such as pedestrian paths or bicycle facilities

The issues considered during the development of a thoroughfare plan should be:

Average
Response (rated from 1, most important, to 5, least important)

3.3	Environmental preservation
2.5	Individual home or business preservation
2.0	Community preservation
2.3	New economic growth
2.3	Community enhancements (better roads, quiet neighborhoods, pedestrian trails, bike trails, etc.)

Part II

What do you feel are the key transportation issues in your community?

- Access to schools
- Additional railroad crossings
- Moving traffic efficiently through town
- Improve signalization
- Widen and improve alignment of Waco Road and Phifer Road
- Make improvements based on need not politics
- Remove unnecessary lights throughout the city (e.g. King Street)
- Lack of implementation of long range plans
- Lack of public transportation
- Routine road maintenance
- Improve access to traffic updates

Are you concerned with safety or accident problems at any specific intersections around the city?

- Dilling Street and US 74 Business
- King Street and Cansler Street
- King Street and Phifer Road
- Railroad crossing at Hawthorne Street
- Gold Street and Sims Street
- Mountain Street and Sims Street
- Intersections at the York Road exit of I-85
- Mountain Street and Phifer Road
- Vehicles running red lights
- Position of the traffic light at City Hall
- Parking on Mountain Street in front of Griffin Drug
- US 74 Business West changes from two travel lanes to one travel lane at Canterbury Road without sufficient warning
- Railroad crossing at Margrace Road
- At numerous intersections vision is obstructed due to plants and signs
- Looking south on Phifer Road from Somerset Drive, the hill is blocked from view by a tree

When traveling around town do you find that you often have to go out of your way to get to where you are going because there is not a direct route? Please give examples.

- When a train is stopped in downtown
- West Kings Mountain to US 74 Bypass and to I-85
- Access to Linwood Road from US 74 Bypass
- Alignment of Gold Street at Battleground Avenue
- Four lane Gold Street to NC 161 and extend to Canterbury Road
- Due to railroad crossings
- Country Club area must go back to King Street
- Need better, open routes to I-85 and US 74 Bypass from uptown
- Congestion around the schools

Do you live in a neighborhood, or know of a neighborhood, where cut through traffic is a problem?

- Maner Road, Gold Street, Mountain Street, and Fulton Drive due to school traffic
- Congestion along Merrimont Avenue in the Ashley Park area

Council to look at highway plan

Residents are being encouraged to drop by City Hall between 4-7 p.m. June 13 and preview the city's bold, proposed thoroughfare plan.

City Council will hold public hearing on the plan June 25 at the 7:30 p.m. Council meeting. If approved by city commissioners, the recommendations will go to a N. C. Department of Transportation board to possibly be included on a five year program that guides state road building, says city planning director Steve Killian.

No priorities would be set on improvements until after the informational meeting and public hearing. The proposed improvements would be built with state money.

The thoroughfare plan has been in the works for some time. Kings Mountain citizens are invited to take a look at the maps on display at City Hall.

Nine road projects are included in the proposals.

Gold Street would run all the

See Thoroughfare, 4-A

THOROUGHFARE

From Page 1-A

way to US 74 East and a road would connect N. C. 216 and N. C. 161 north of the city.

I-85 would be widened to eight lanes East of the U. S. 74 Bypass interchange and U. S. 74 Bypass would be widened to six lanes.,

A right turn lane would be created into Kings Mountain High and Middle Schools on Phifer Road.

The Hawthorne Road and Baker Street railroad crossings would be closed.

Patterson Road would be widened to two 12 foot lanes to accommodate a proposed interchange.,

A two-lane connecting road from N. C. 161 to N. C. 216 just south of Chestnut Ridge Church Road would be built and both state roads would be widened to four lanes. N. C. 161 would be widened to five lanes through the city.

A 216 Bypass would be constructed by continuing the planned Dixon School Road extension north of U. S. 74 business, creating an interchange at the U. S. 74 bypass at Patterson Road and connecting it to N. C. 216 just south of Goforth Road.

Summary of Comments
June 13, 1996
Drop In Session

- Support for recommended exclusive right turn lane into the high school and the middle school

- Support for the recommended TIP R-2625 extension (NC 216 Bypass)

- Support for the recommended widening of NC 216 north of US 74 Bypass

- Support for the recommended extension of Gold Street

- Concern about the location of recommended TIP R-2625 extension (NC 216 Bypass) with respect to Gold Run subdivision

  Reply: The thoroughfare line was located so as not to disrupt existing Gold Run

- Concern that the recommended widening of NC 161 will leave property owners with no yard

  Reply: The State handles right of way acquisitions based on a case by case situation -- In some cases the State may buy the entire piece of property

- Opposition by affected property owner to the funded TIP R-2625 -- how was the public hearing publicized? -- how long has this been planned? -- when will we be contacted for right of way acquisition?

  Reply: Provided names and phone numbers of the Citizens Participation Unit and of contacts for right of way acquisition -- Researched the history of the project and found that it was published in the *1989 Transportation Improvement Program*

- Concern over emergency vehicle access to the western side of Kings Mountain due to congestion along Phifer Road at the schools and due to the Railroad tracks

  Reply: We are recommending an exclusive right turn lane at both the high school and the middle school to help relieve congestion, TIP R-2625 will be grade separated with the Railroad, and the recommended NC 161/NC 216 Connector is recommended to be grade separated with the Railroad

Appendix G

Glossary of Technical Terms

Average Daily Traffic Count (ADT) - Traffic counts taken by the North Carolina Department of Transportation.

Calibrate Gravity Model - The computer modeling process by which friction factors are calculated using trip length frequency curves for an area.

Calibration - The process by which various factors are adjusted in order to duplicate existing travel patterns as accurately as possible.

Centroid - The center of the traffic zone activity.

Cordon Station or External Station - The place at which the planning area boundary crosses each facility.

Facility - A road.

External<->Internal Trips - Trips that have one trip-end inside the planning area and one trip-end outside the planning area.

Gravity Model - A computer model which distributes trips according to land use and transportation system characteristics.

Home Based Other Trips (OHB) - Trips made inside the planning area from home to some place other than work.

Home Based Work Trips (HBW) - Trips made inside the planning area from home to work.

Internal Data Summary (IDS) - A computer program written by Michael Bruff, P.E., of the Statewide Planning Branch, which calculates trip productions and trip attractions for use in the gravity model.

Internal Trips - Trips with both trip-ends inside of the planning area.

Link - A segment of the street system to which various attributes of the facility can be assigned.

Major Thoroughfare - A facility which carries high volumes of traffic within and through the planning area.

Minor Thoroughfare - A facility which collects traffic from local access streets and carries it to major thoroughfares.

Network - A computer representation of the existing or future road system.

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Non-home Based Secondary Trips (NHBS) - Internally generated trips made by vehicles garaged outside the planning area.

Non-home Based Trips (NHB) - Trips made inside the planning area where neither the origin or destination is home.

Planning Area Boundary (PAB) - The boundary delineating the current city limits and the outlying areas that are projected to develop by the design year.

Screenline - An imaginary line generally following natural or physical barriers (i.e., a river, railroad, or freeway) that is established to intercept major traffic flows in the planning area.

Synth - A set of models created by David Modlin, Jr., P.E., Ph.D. and computerized by James McDonnell, P.E. which calculates through trips.

Through Trips - Trips produced outside of the planning area which pass through the planning area to a destination also outside of the planning area.

Traffic Zone - Subsections of the planning area that are used to connect and define land use values to the transportation network.

Trip-end - A trip origin or destination.

Trip Attractions - Trips attracted to zones using employment data and regression equations.

Trip Productions - Trips produced by zones using housing and commercial vehicle data and generation rates.